ELECTRICAL REVIEW

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20th August, 1948

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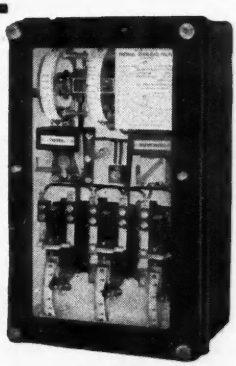

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXLIII. No. 3691 20th AUGUST, 1948 9d. WEEKLY

Prices and Deliveries

RESPONSIBILITIES OF THE WORKERS

IT sometimes seems as though the workers in industry suspect that the insistent call of the Government (although it is a Labour Government) for greater production is somehow designed to secure greater profits and not (as is the fact) to ensure the country's survival. It is, therefore, refreshing to find the subject realistically dealt with in a trade union journal, even if the author gets his inspiration from shortcomings in our undertakings to Soviet Russia.

The article in question is by Mr. Tom Gillinder in the *Monthly Journal* of the Amalgamated Engineering Union; it is headed "Are British Workers Retarding Trade with Russia?" and the author seems to answer the question in the affirmative. He bases his article on a statement in the *Soviet Weekly* that "the greatest obstacle to the conclusion of [Anglo-Russian] contracts is the failure of British firms to give any guarantees of delivery dates, or to specify the precise cost of the equipment to be supplied."

Employers Exculpated

If it is not just a question of shortage of materials, says Mr. Gillinder, it is necessary to find out why this delay has arisen when expanded trade is so vital.

> "Only the blind leaders of the blind will dogmatically avow that all employers are conniving to sabotage the agreement, regardless of economic consequences, and that all workers are straining at the leash to get cracking with these jobs, collaborating to ensure delivery dates and reasonable prices being maintained."

The situation in which delays in delivery and high prices are holding up an expansion which would cure this country's economic ills cannot be disposed of by accusing employers of inefficiency or placing the onus of reducing prices solely on profit margins. After all that has been said on the subject, it is an encouraging sign (unless he is a voice crying in the wilderness) that Mr. Gillinder quotes, with tacit approval, from the official publication "Target" a statement to the effect that profits do not represent a bottomless purse and that additional earnings must be based on extra output.

Joint Action Necessary

It has been urged by the Trades Union Congress that prices and profits should be more rigorously controlled to prevent inflation but, Mr. Gillinder says, it is merely elementary intelligence to suggest that if employers are to be influenced to restrict profits workers should give full co-operation in keeping export market prices attractive to customers and potential buyers. He also contends that the important matter of quality is the responsibility of both workers and managements.

It is suggested that the best means of securing the necessary co-operation between the two sides of industry is the strengthening of Joint Production Committees. On this matter he refers to union representation and says that union prestige is greater than mistaken loyalty to shop stewards disposed to disregard the limitations of their duties and he urges

members to elect the right kind of representatives, "competent to judge between matters exclusive to the factory or industry and those that belong to the branch or the community."

We commend Mr. Gillinder's views to the attention of our readers as an indication that the trade unions are aware of their responsibilities and shortcomings and should be encouraged to contribute to the working out of a solution to our most urgent problems.

THE WIDER VIEW

ABOUT a hundred fortunate individuals employed by the British Electricity Authority and the Area Boards have had an instructive and pleasant time this week at the first Summer School organized by the authorities. As Lord Citrine points out in a message prefacing the programme, although the primary aim of the School has been educational its social aspect has been no less important. Men of all grades of the service from all parts of the country have lived together for a week and have absorbed ideas which should render them better electrical servants of the public.

F.H.P. MOTOR PRODUCTION

UNTIL recently fractional h.p. motors caused much delay in the completion of all kinds of motor-driven machinery, but now the production appears to be much easier. Manufacturers undertook two or three years ago to restrict direct exports of f.h.p. motors in favour of home buyers but the Ministry of Supply has released them from their undertaking. It still asks them to do all they can to ensure that home machine manufacturers secure all the motors they need. They are also urged to direct their exports into the most desirable markets from the exchange point of view.

EXPORT OBSTACLE

THERE is still a belief among some manufacturers in this country that all foreign buyers can speak our language, or if not they should do so. The Export Promotion Department of the Board of Trade says that it is continually receiving complaints from its overseas officers and importers abroad that trade literature is often provided by U.K. manufacturers without translation into the native language, or with a badly prepared version. It is pointed out that in the case of specialized engineering goods adequate information is particularly important. Even firms exhibiting at overseas fairs have failed to provide material in the local language, although if a foreign concern acted in the same way here we should no doubt consider it strange.

LAND FROM ASH

POWER station ash, frequently a source of complaint, is to be applied to a useful purpose at Wigan, where a £5,000,000 station is at present under construction. It is proposed to use the ash to reclaim Westwood Flash, which will be gradually filled in over a number of years, thus—to quote the *Wigan Examiner*—adding to the borough a large and valuable section of land in a central position.

"FROZEN" DIVIDENDS

SIR STAFFORD CRIPPS was not quite fair when he said that a quarter of the companies whose accounts had been published since his appeal for the stabilization of dividends had raised their distribution and were thus "jeopardizing the whole voluntary basis of the scheme." It is pointed out by the Federation of British Industries, after investigation, that of 329 companies (out of 1,361) who had increased their dividends all but about 60 were justified and the issued capital of 58 of these totals only £17·4 million out of a total for all public companies on the Register at the end of 1946 of £4,078 million. Thus it cannot be said that the Chancellor's request has proved fruitless.

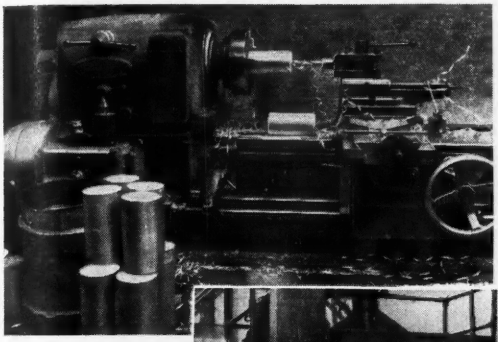
REHEATED STEAM

OWING to higher fuel costs, ten or so generating plants embodying reheating are being built in the United States for operation early in 1951. According to calculations given in the *Electrical World* (3rd July, 1948), the thermodynamic economy of reheating the steam to its original temperature after it has given up part of its energy to the turbine is enough to pay upwards of 23 per cent on the capital costs of the additional equipment. There are at present only nine reheat plants in the U.S.A. Reheating was first used in North Tees station, which was started up some twenty-five years ago, and has since been adopted in other British stations.

Light Metal Tube Production

Extrusion and Drawing Processes

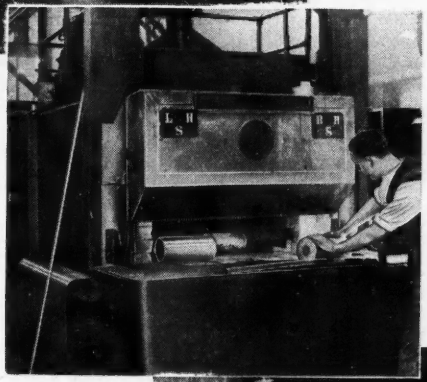
IN the *Electrical Review* of 6th June, 1947, we described how the raw materials of the factory at Birmingham of Birmetals, Ltd., i.e., pure aluminium ingots and alloying elements, are treated in reverberatory furnaces and special casting machines in preparation for the production of billets suitable for the extrusion of all manner of sections. The extrusion processes were also described. One department of the factory is devoted exclusively to the production of tubes from "Birmabright" magnesium-aluminium alloys, and these tubes find their way to other factories where they serve as the raw material for the production of electric torches and furniture, to mention only two of a very wide range of wares. It is our object in this article to describe the electrical applications to the tube-making processes.



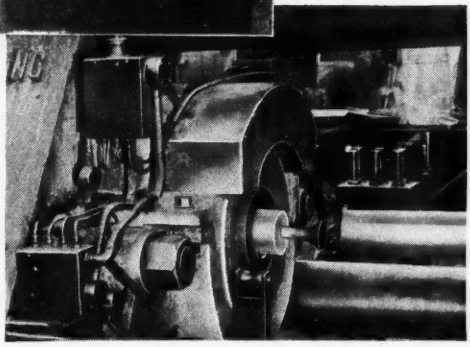
Billets are drilled longitudinally through their centres

Similar cylindrical billets are required for tube production, except that in this case they are first drilled longitudinally through their centres before they leave the casting shop. We saw this operation carried out on a horizontal boring lathe with a four-centre self-centring chuck. This lathe is driven by a 20-h.p. English Electric squirrel-cage motor with transmission first through a two-change-speed gear box giving speeds of 1,000 and 2,000 r.p.m., and then by V-belt to the lathe shaft. "Plugging" is employed for quickly stopping this motor, and the Igranic control equipment incorporates a special contactor for this purpose.

From the bored billets are extruded thick-wall tubes or shells which are subsequently drawn to the required sizes. In preparation for the extrusion the billets are preheated in suitable electric furnaces. One of these is a hand-loaded travelling-type furnace with two conveyor lines in the sole of the furnace chamber which is about 30 ft long, 6 ft wide and 4 ft high internally.

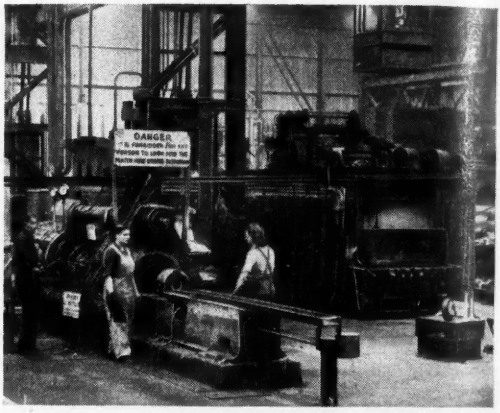


In preparation for extrusion the billets are preheated in travelling electric furnaces; 150 kW—two zones
Below: The billet with mandrel is inserted in the electrically heated container



The conveyors are driven by a 5-h.p. 940-r.p.m. direct-on-line motor situated on the furnace roof, and transmission is through an enclosed gear box to pinion gearing and then to a shaft carrying a ratchet gear which engages with the conveyor drum shaft. The conveyor speed is 3 ft per min.

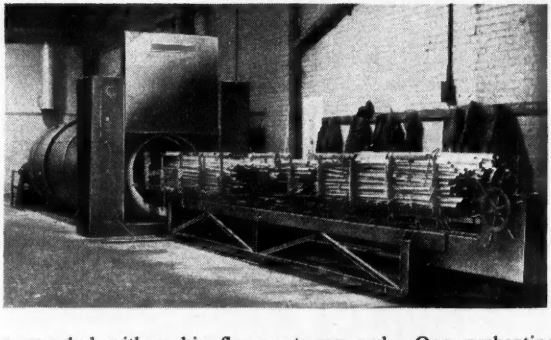
The furnace loading is 150 kW and there are two working zones, each with three-phase star-connected elements. The elements are situated at the top of the chamber in a ducting formed by and between the encased heat-insulating wall outside and the chamber lining inside. They are of nichrome wire on porcelain formers. The working temperature of 520 deg C is automatically controlled by Kent potentiometric instruments which actuate Brookhirst contactors. The zones are separately controlled. A fan in the element duct, driven by a 16-h.p., 1,460-r.p.m. motor on the roof, recirculates hot air out from the duct into the chamber and back to the duct. The exit door is motor operated. This furnace is a Gibbons, Wild-Barfield product with Crompton Parkinson motors.



One preheating furnace and an adjacent extrusion press usually work together

At the unloading end of the pre-heating furnace the heated billets roll out on to receiving " hooks," and while in this position each billet. By means of tongs suspended from a runway the billet, with its mandrel, is carried to the adjacent horizontal extrusion press. After insertion of the billet in the press container a pusher plate is also inserted ready for transmitting the pressure directly from the ram on to the flange of the mandrel. At the other end of the mandrel the extrusion takes place through the annular space between the die, which is inserted before the billet, and the spindle of the mandrel, under a pressure of about 40 tons per sq in.

To maintain the billet temperature immediately before and during extrusion the press container is electrically heated by mineral-insulated nickel-alloy sheathed elements embedded in the container housing near the interior surface. To facilitate disconnection of the external connections of the elements when the two sections of the container housing are separated, there is an arrangement of special connecting boxes with screw-on gland connections. The container heating load is about 70 kW.



Tubes are annealed at various stages during the drawing processes; 150-kW, single zone furnace

a mandrel with a big flange at one end, rather like an internal-combustion-engine cylinder valve, is slipped through the hole in

One preheating furnace and an adjacent extrusion press usually work together.

Although all the extrusion presses in the

works are available for tube production, the bulk of this work is carried out by the 3,000-ton press. This and another one of 2,000 tons are served by a hydraulic station equipped with three three-throw horizontal ram pumps which automatically maintain a pressure of 4,250 lb per sq in. in a hydraulic-pneumatic accumulator system. Each pump is driven by an E.C.C. 350-h.p., 750-r.p.m. synchronous induction motor which transmits through pinion speed-reducing gear to give a speed of 120 r.p.m. at the pump shaft. In operation any one motor runs constantly, its pump being automatically loaded and unloaded by valves operated by rises and falls of the pressure in the accumulator system.

Drawing Process

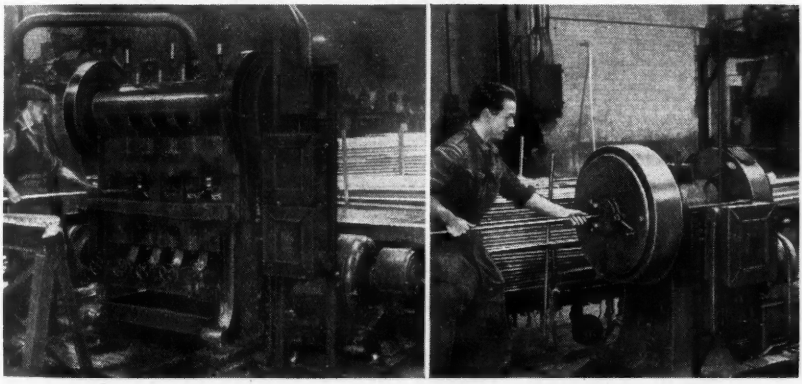
A $1\frac{7}{8}$-in. outside diameter shell with a $\frac{1}{16}$-in. wall is a standard size which provides a very wide range of drawn tubes down to $\frac{1}{8}$-in. outside diameter. The tubes are given a number of passes through dies on draw benches, normally with reductions of $\frac{1}{8}$ in. or $\frac{1}{16}$ in. o.d. and one S.W.G. step of the wall thickness per pass. The following may be cited as an example of the early drawings, starting with the extruded shell:—$1\frac{7}{8}$ in. o.d.—0·187 in. gauge thickness 12 in. long; $1\frac{3}{4}$ in. o.d.—0·160 in. gauge thickness 14 in. long; $1\frac{5}{8}$ in. o.d.—0·144 in. gauge thickness 16 in. long; $1\frac{1}{2}$ in. o.d.—0·128 in. gauge thickness 18 in. long.

As the tube gets smaller the gauge reductions become considerably less, and an example of a group of reductions towards the final end of the range is:—$\frac{5}{8}$ in. o.d.—0·032 in. gauge thickness; $\frac{9}{16}$ in. o.d.—0·028 in. thickness; $\frac{1}{2}$ in. o.d.—0·022 in. thickness; $\frac{7}{16}$ in. o.d.—0·020 in. thickness.

In all the above drawings the outside diameter is determined by the size of die through which the tube is drawn, and the gauge thickness is determined by a plug actually in the tube, and over which the tube is drawn, at the die position. For the very small sizes of tube it is usually desirable to make the final drawings without the plug, and this "sinking" results in increasing the gauge thickness:—$\frac{3}{8}$ in. o.d.—0·22 in. gauge thickness; $\frac{5}{16}$ in. o.d.—0·23 in. thickness; $\frac{1}{4}$ in. o.d.—0·245 in. thickness; $\frac{3}{16}$ in. o.d.—0·26 in. thickness; $\frac{1}{8}$ in, o.d.—0·275 in. thickness.

To overcome the hardening effect of the drawing operations on the tube metal the tubes are annealed at various stages during this process. At the commencing end of the operations annealing is usually required after making four reductions, but as the tube becomes smaller the frequency of annealing per number of passes is increased. The horizontal cylindrical G.W.B. electric annealing furnace is about 30 ft long and 8 ft in diameter. It has a metal-encased shell of heat insulation on the outside, and between this and the chamber lining are the heating elements. There are several longitudinal lines of elements round the furnace wall, the elements proper in each line being zig-zagged.

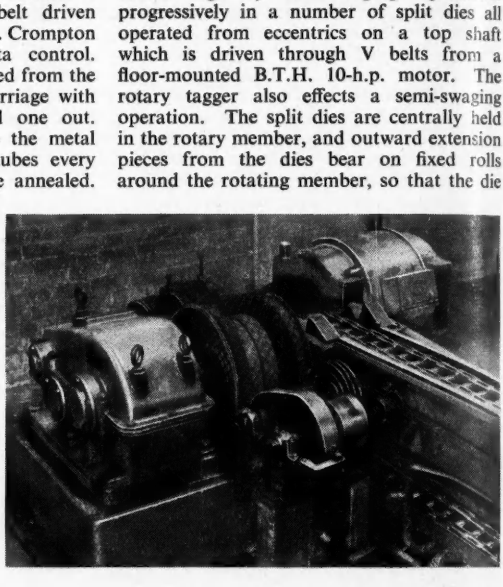
There is just one heating zone, the whole of the star-connected elements being switched on and off together. The loading is 150 kW



Dolly tagging (left) and rotary tagging (right) are two of the three methods employed

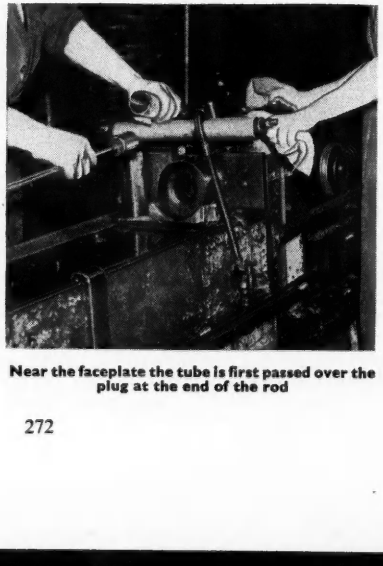
and the working temperature is 380 deg C. The Brookhirst contactors are actuated from a Kent central control station by potentiometric instruments which operate on the fixed and moving pointer principle. Centrally at the back end of the furnace is an internal air-circulating fan belt driven by an external 15-h.p., 1,440-r.p.m. Crompton Parkinson motor with star-delta control. The furnace is loaded and unloaded from the same end by a hand-operated carriage with two charging lines—one in and one out. To prevent oil being burnt into the metal it is essential to degrease the tubes every time immediately before they are annealed. This is done by an I.C.I. trichlorethylene vapour degreasing equipment.

When the tubes reach a length of about 18 ft to 20 ft during the drawing operations they are cut by a simple motor-driven bench saw into about 9-ft lengths. Before they are introduced to the draw benches the tubes are tagged down at one end to permit their being gripped by the dogs on the draw benches. Three methods of tagging are employed—flat, dolly and rotary. Flat tagging is effected on the simple drop-hammer principle, the machine employed having a compressed-air operated hammer. A floor-mounted B.T.H. 15-h.p., 730-r.p.m. motor is directly coupled to a crank mechanism which operates a simple compressor unit. The air is released under foot control.



A 30-h.p., 710-r.p.m. motor serves the largest draw bench; chain speeds 40 ft and 70 ft per min

The dolly tagging machine produces round tags by semi-swaging operations progressively in a number of split dies all operated from eccentrics on a top shaft which is driven through V belts from a floor-mounted B.T.H. 10-h.p. motor. The rotary tagger also effects a semi-swaging operation. The split dies are centrally held in the rotary member, and outward extension pieces from the dies bear on fixed rolls around the rotating member, so that the die sections are closed in at each engagement with the rolls. An E.C.C. 10-h.p., 970-r.p.m. slip-ring motor drives this machine, with straight pinion transmission on to the rotor shaft. Retagging is sometimes necessary at various stages during the reductions.

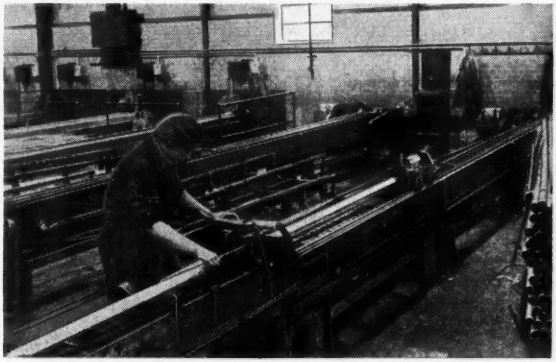


Near the faceplate the tube is first passed over the plug at the end of the rod

A comprehensive installation has its draw benches progressively arranged in line, side by side, with the largest machine at one end and the smallest at the other end. Thus no matter what degree of reduction is required or what are the initial and final sizes of tube, the production flow is always in one direction. In principle all the machines are the same, each consisting essentially of the drawing section and the loading section at the same level, with a faceplate which holds the die at the junction of the two sections.

Near the faceplate the tube is first passed over the plug at the end of the rod on the loading section. The plugs are so threaded that a number of them of different sizes can be used with one size of rod. When the

complete length of tube has been passed over the plug and rod the tagged end is passed through the tungsten-carbide die in the faceplate, and introduced to the dog (gripping jaws) on the other side of the die. The dog is mounted on a travelling carriage which is clutch-engaged as required with the constant-travelling chain. The carriage can be released from the chain at any point, and it can be returned to the faceplate by a system of ropes and pulleys which run idle when drawing is taking place, but can be engaged by a fast-operated clutch.



The dog carriage is clutch-engaged with the constant-travelling chain

An E.C.C. 30-h.p., 710-r.p.m. slip-ring motor serves the largest draw bench. Transmission is first through a two-change-speed gear box and then through a reducing gear on to the main driving sprocket of the drawing chain, to give chain speeds of 40 ft per min and 70 ft per min. The motor is controlled by an oil circuit-breaker and an oil-cooled rotor resistance starter.

The smallest draw bench is driven by a 15-h.p., 715-r.p.m. squirrel-cage motor with a star-delta starter. The transmission scheme is similar to that of the largest draw bench, and the two chain speeds are 50 ft per min and 80 ft per min.

Tube-finishing operations include sawing to length by motor-driven high-speed bench saw wheels, cleaning and straightening. All the smaller sizes of tubes, say, 1 in. outside diameter and below, are passed through a reeling machine for straightening. The tube travels longitudinally between two lines of rollers, one power driven and the other idle. The two lines are set at opposing angles, of about 45 deg to the horizontal. The rolls both rotate the tube and propel it longitudinally.

This reeling machine is operated by a 45-h.p., 960-r.p.m. motor with two 3 to 1 belt transmissions and, in turn, two enclosed gears from each of which one of the two power rolls is driven at 120 r.p.m.

We are indebted to Birmetals, Ltd., for permission to visit the works and to publish this article.

Dolgarrog Hydro-Electric Station

Catchment Area Extension in North Wales

IT is announced that the British Electricity Authority has approved of a scheme to increase the catchment area of the Dolgarrog hydro-electric station, North Wales, with a view to raising the annual output of the station from 42,000,000 kWh in a year of average rainfall to between 50,000,000 and 53,000,000 kWh.

In the Dolgarrog station, which is in the Merseyside and North Wales Generating Division of the Authority, the installed plant comprises three Pelton wheel alternators, one of 6,500-kW capacity and two each of 5,000-kW capacity, together with a small 1,200-kW D.C. set. For a considerable number of years, the station has been run in parallel with the national grid through its connection with the distribution system of the former North Wales Power Company.

The scheme now approved, which is estimated to cost £283,000, provides for the extension of the catchment area by some 3,400 acres, involving the construction of several miles of leats, or open canals, a tunnel approximately a mile long and an extension of the present Coety reservoir.

There are two pipe lines to the station, one from Llyn Cowlyd giving a working head of about 1,075 ft and the other from Coety reservoir giving a working head of about 800 ft. The alternators can be operated from either pipe line and the increased output from the station will be obtained without the provision of additional generating plant.

Views on the News

By REFLECTOR

IT is reported that the St. Marylebone Council has under consideration the installation of telephones by tenants of Council houses. Its Housing Committee hitherto has refused permission for the installation of telephones for private or social use on the ground that the houses are primarily intended for "working-class persons" who presumably cannot afford to pay an economic rent and therefore really cannot afford telephones. This policy may be justified but I cannot help remarking that as it is now customary to install refrigerators in subsidized houses it is a little hard to object to telephones—if they can be obtained.

◆ ◆ ◆

Reference was made in my notes of 16th July to whale-killing methods. Now I hear that a British whaling company has purchased an electric harpoon outfit from Norwegian manufacturers. The electric harpoon is claimed to kill or at least paralyze the whale immediately, while it is free from the drawbacks of other methods including the laceration of the flesh and shell splinters.

◆ ◆ ◆

I have just seen a picture of the coat of arms granted to the South West Scotland Electricity Board.* In general it is very "territorial": it includes the Stewart device, the Glasgow salmon, the Clydesdale cinquefoil and antelope, the Douglas & Hamilton horse and the Galloway lion. Electricity is represented by a silver-winged thunderbolt (not a lightning protection device) and a "radiated collar" on the antelope which seems to have turned the top half of the animal green. Altogether a very interesting collection.

◆ ◆ ◆

A South African correspondent sends me the strange story of a Rand electrician's *modus operandi*. Among this Mr. van Ryneveld's gear is a case containing two mice and a test-tube holding a few beetles. Mr. van Ryneveld explains: "We once had to thread cable up a conduit which ran all the way up eight floors of a ten-storey building. When you consider that the weight of the cable was more than 100 lb, you will appreciate the difficulty we had. How to get the cable up the conduits? We had to pull it up with string, of course, but the problem was first how to thread the string through the pipe. An apprentice caught us a rat; we tied cotton to its back leg, and then let it run up the pipe. When it appeared on the top floor, we pulled the cord up, and eventually pulled up the cable itself. The beetles are for single-storey jobs. When we have to negotiate a bent conduit with cable, we send a beetle up with a cotton tied to its leg. This does the trick—but the quickest beetle takes at least four hours for his 12-ft trip." Mr. van Ryneveld says he waited five days for a beetle to emerge from a conduit on one job. The employment of rats in this way is not new but I had not heard of beetle-mates in the electrical contracting industry. They seem a trifle slow.

◆ ◆ ◆

In the *Evening News* one day last week it was reported that:—

> "Young civil servants to-day stroll beneath trees which were brought from all over the world to surround the Berkshire mansion headquarters of the Southern Area Electricity Board. Some £70,000 has been spent bringing the trees from countries as far distant as Central Europe, Asia and the Himalayas."

Apart from the fact that employees of the Board are not civil servants, the report gives the impression, only half-corrected in a later paragraph, that there has been special afforestation by the Board at considerable expense. This is somewhat tendentious, I think.

◆ ◆ ◆

A fellow "columnist" in the *Manchester Guardian* mentions a number of methods adopted for lighting which he puts forward for the consideration of the Minister of Fuel and Power. They include the use of luminous ink for the directories in telephone boxes, theatre programmes and evening papers. Then, of course, there are the live luminants —glow-worms, fire flies and "lantern" beetles. It is asserted that four of a particular type of lantern beetle throw a pool of light "several feet round"; these should be useful for street lamps and I commend the idea to the Association of Public Lighting Engineers, although there may be some difficulty about import licences.

* A picture appears in this issue.—EDITORS, *Electrical Review*.

Medium-Voltage Distribution

Effect of Diversity on Loading and Layout

By R. B. ROWSON, B.Sc., A.M.I.E.E.

VOLTAGE conditions in medium-voltage systems are sometimes not as unsatisfactory as calculations would lead one to expect. Long lengths of two-wire lines often supply unexpected numbers of relatively large consumers. It is the purpose of this article to suggest the underlying reason for the apparently good performance of two-wire systems and to question the useful capacity of three- and four-wire networks when compared with them, by paying regard to the reduction in after-diversity demand which occurs as the number of consumers increases. The conclusions reached may help to clarify the vexed question as to whether three-phase systems are justified in rural development.

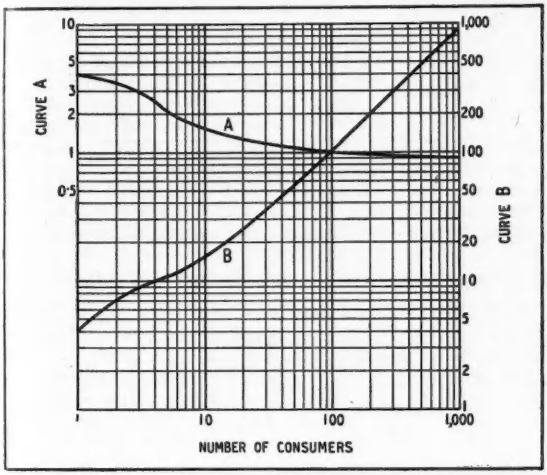


Fig. 1.—Relationship between number of consumers and maximum demand when a.d.d. for 100 consumers is 1 kW each. Curve A, after-diversity demand, kW per consumer. Curve B, resulting kW of total demand

Several sets of figures for the a.d.d. of domestic consumers have been published in the *Electrical Review* (e.g. Schiller, 9th April, 1943, and Jolley, 10th September, 1943), and it is hoped that further data will be available in due course from

Table 1. Considerations Affecting Voltage Drop

Number of consumers	kW yd to be carried; unit spacing, two-wire system		Percentage reduction due to diversity	kW yd to be carried by each phase of four-wire system	kW yd to be carried allowing diversity. Unit spacing of consumers	
	With diversity	No diversity			Four-wire system	Three-wire system
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	4	4	0			
2	11	12	8			16
3	20	24	16	12	36	
4	30	40	25			44
5	40	60	33			
6	52	84	38	33	99	80
7	64	112	42			
8	78	144	46			120
9	92	180	49	60	180	
10	107	220	51			160
11	123	264	53			
12	140	312	55	90	270	208
24	422	1,200	65	234	702	560
36	848	2,644	68	420	1,260	1,052
48	1,418	4,704	70	654	1,962	1,688
50	1,527	5,100	70	720	2,160	1,808
75	3,280	11,400	72	1,356	4,068	3,568
100	5,430	20,200	73	2,184	6,800	6,108
150	11,700	45,300	74	4,581	13,743	12,800

B.E.A. tests. In the meantime curve A of Fig. 1 might be taken as representing average conditions, excluding substantial space heating. Curve B gives the resulting demand for different numbers of consumers, on the assumption that the a.d.d. is 1 kW when 100 consumers are involved.

Whilst a simplified model, necessary to facilitate calculations, may be open to objections, it is proposed to assume one is dealing with a housing estate with premises spaced at "s" yards apart and equipped with similar apparatus, but excluding the use of electricity for the main heating requirements. It is required to obtain an indication of the voltage drops to be catered for so that the spacing of substations and the type of distributor may be considered. With this simple layout, the model for ten consumers is as shown in Fig. 2 (*a*) and if the a.d.d. with one consumer is 4 kW the loads on each section of distributor are 4, 8, 12.....40 kW, if no diversity is allowed. The diversities implicit in Fig. 1, curve A, reduce these to 4, 7, 9 ..... 15 kW, as shown in brackets.

The voltage drop is proportional to the kilowatt-yards which are summed in Table 1, cols. 2 and 3, for unit spacing. The table is extended in detail to twelve consumers and in skeleton to 150. It will be noted from col. 4 that diversity reduces the voltage drop by 55 per cent when the number of consumers reaches twelve, increasing to a 74 per cent advantage for 150 consumers. These large reductions explain why apparently too long single-phase mains are able to afford reasonable service.

Table 2. Comparison of Current Carrying Capacity Required for Various Systems

Number of consumers	Ratio of capacity to be provided, two-wire system = 1		Economic ratio		
	Four-wire	Three-wire	Two-wire	Three-wire 3 ÷ Col. 3	Four-wire 3·7 ÷ Col. 2
(1)	(2)	(3)	(4)	(5)	(6)
12	1·9	1·5	1	2	1·95
24	1·65	1·32	1	2·28	2·24
36	1·48	1·24	1	2·4	2·5
48	1·38	1·2	1	2·5	2·68
100	1·25	1·12	1	2·68	2·96
150	1·17	1·09	1	2·75	3·16

Cols. 2 and 3 would also apply to three-phase systems if, and only if, the service to each consumer and his loads were supplied three-phase. To amplify this point, consider the twelve consumers in Fig. 2 (*b*). There will be four on each phase and the kilowatts transmitted on each section will be as indicated, if diversity is allowed. The separation between each consumer is now 3s instead

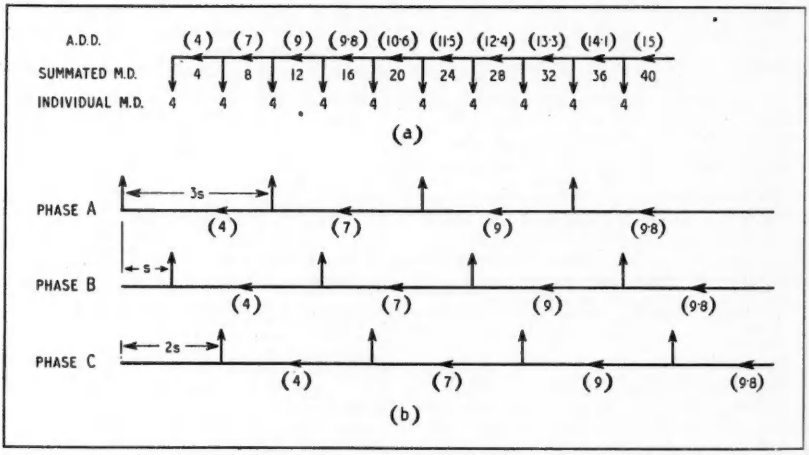


Fig. 2.—Loadings in sections of distributors with individual consumers' demands of 4 kW spaced s yards apart; (a) Ten consumers supplied from two-wire system; (b) Twelve consumers supplied from four-wire system

of s which increases the kW yd for each phase to those shown in col. 5. There is thus the double effect of fewer consumers on each phase, which reduces diversity, and a greater distance between the services supplied from each phase, which increases voltage drop. The total capacity to be provided by a three-phase system is three times that for each phase and is given in col. 6.

For twelve consumers 90 per cent more capacity has to be provided than would be dealt with by a single-phase distributor. This discrepancy falls to 65 per cent for twenty-four consumers, but even so, it appreciably reduces the economic advantage of a three-phase line as compared with the single-phase system it often replaces. Figures for other numbers of consumers are given in Table 2, col. 2, in terms of the ratio of the capacity to be provided by a four-wire system divided by that which would need to be provided by a two-wire system.

For the same reasons the comparison between a two-wire and a three-wire system is not quite so unfavourable, as in this case the consumers are only divided over two phases and the distance between consumers supplied from any particular phase is only two-thirds that of the three-phase case. The effect of these points will be noted in comparing cols. 2 and 3 of Table 2.

It is normal practice to regard two-, three- and four-wire systems with similar conductors as having carrying capacities in the ratios 1: 4: 6. Due to loss of diversity, etc., the effective capacities are very different. For thirty consumers, for example, the proportions are 1 : 3·23 : 4·05, which shows that whilst the effective capacity of a three-phase system is only about two-thirds of the accepted figure, the discrepancy is not so great in the case of the three-wire system.

One of the standard exercises in most textbooks is to show that economically the four-wire system is the best, the kVA transmitted per £1 of capital (assuming costs to be in the ratio of 1: 1·3: 1·6) being in the ratio of 1 : 3 : 3·7 $\left(\text{i.e. } \frac{1}{1} : \frac{4}{1 \cdot 3} : \frac{6}{1 \cdot 6}\right)$. This early lesson usually forms part of the engineer's subconscious thought and leads to unnecessary expenditure on four-wire systems when two- or three-wire distributors would often meet the situation more economically.

The foregoing considerations, however, modify this teaching so that for twenty-four consumers the proportions are approximately 1: 2·28: 2·24. Up to fifty consumers the three-wire system still has the advantage if allowance is made for substation costs and even when 100 to 150 consumers are served from one distributor, the four-wire system shows little economic advantage as comparison of cols. 5 and 6 of Table 2 will show.

Machine Tool Drives

IT is very often the case that an induction motor driven clutch-operated machine tool is required to accelerate a high inertia load to a relatively high speed. It is then likely that during the initial clutching period the peak current will become large enough to operate the overload trips. The installation of a more powerful motor may cure the trouble, but it is not the best solution to the problem, because the real cause of high peak current is the too rapid engagement of the clutch.

When the clutch is engaged too rapidly the slip is low and maximum torque is transmitted, causing an immediate drop in speed. The need is for a motor with a speed/torque characteristic such that as the speed falls it develops far less torque on the inverse part of the curve.

To obtain satisfactory operation it is necessary to use a motor with 8 to 10 per cent slip as compared with the more usual 4 per cent. In effect, the high slip of the motor compensates for the absence of slip when the clutch is engaged fiercely, thus preventing overload problems.

To prove that this arrangement minimizes the results of fierce clutching, tests have been made by Crompton Parkinson, Ltd., with a high inertia face-plate load driven first by a standard machine and subsequently by a " Hyslip-Tork " motor.

The first machine was a 15-h.p. " Klosd " type and a recording ammeter was arranged to measure the current taken when the clutch was engaged to accelerate the face plate from rest to 300 r.p.m. Repeated tests indicated that the peak current during the two seconds initial clutching period was 76 A and the time taken to accelerate to full speed 10 seconds. With a 15 h.p. " Hyslip-Tork " machine, operating under the same conditions, the peak current during the first two seconds was reduced to 38 A although the time for acceleration to full speed was still 10 seconds.

Apart from the lower peak current of the high-slip machine, the rate of current rise is less than with a standard motor. It seems, therefore, that the use of a high-slip motor is the logical method of preventing excessive peak currents, because it ensures that " slip " is introduced automatically regardless of how the clutch is operated.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Southern Electricity Board has appointed as its purchasing officer **Mr. R. B. Sulley,** M.B.E., B.A., M.I.E.E., formerly purchasing officer, appliances, Edmundsons Electricity Corporation. He succeeds Mr. E. L. Gethin, who has taken up an appointment with the B.E.A. **Mr. E. M. Kindersley,** B.A., becomes personnel officer.

To mark his completion of fifty years' service with W. T. Henley's Telegraph Works Co., Ltd., **Mr. Frank Dixon** has received a special presentation from the company. He is one of three brothers who have created a remarkable record by completing jointly no less than 153 years' service with the same firm. The presentation was made by Sir Montague Hughman, chairman of the Henley organization, who had made similar presentations to each of the other two brothers when they had completed their fifty years.

Mr. H. Trowsdale has been appointed station superintendent at Falkirk power station. He served his apprenticeship with the Aberdeen Corporation Electricity Department, and in 1920 he was appointed charge engineer at Falkirk Corporation power station which position he held until 1947 when he was promoted to be senior charge engineer.

Mr. W. J. Cooper, M.I.E.E., administrative officer of the South West Scotland Electricity Board, has been appointed sub-area liaison officer and personal assistant to the chairman and vice-chairman of the Board. Recent sub-area appointments by the Board include the following:—*Glasgow.*—Messrs. A. P. Robertson, M.I.E.E. (engineer) and D. McDougall, A.M.I.E.E. (commercial officer). *Clyde.*—Messrs. W. H. George (engineer) and H. R. Taggart (commercial officer). *Ayrshire.*—Messrs. A. M. Fleming (purchasing officer) and W. E. Upton (engineer). *Lanarkshire.*—Messrs. W. B. Bruce (engineer) and W. D. Brassington, A.M.I.E.E. (commercial officer). *Dumfries and Galloway.*—Mr. S. H. Money (engineer).

At a meeting held in the canteen of the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., on 30th July, appreciation of the work carried out by **Mr. Stansfield** was expressed by various members of the staff on his retirement after forty-eight years' service. A radio set subscribed for by his friends in the L.D.C. Group organization was presented by Mr. A. W. A. Dick-Cleland, general manager of the works. Mr. Stansfield has been associated for many years with the company's design and development work and latterly has been especially interested in conjunction with Watson Laidlaw & Co., Ltd., in the application of electric drives to centrifugals for sugar machinery and hydro extractors for textile and laundry machines. A presentation of an easy chair was also made to **Mr. J. Roberts,** of the cost and wages department staff, who was also retiring after forty-two years' service.

Mr. W. J. Girvan, city electrical engineer of Belfast, has accepted an invitation to represent Northern Ireland on the committee which is considering plans for the 1949 British Electrical Power Convention.

Mr. H. A. C. Ridsdale, B.SC.(ENG.), at present with British Insulated Callender's Cables, Ltd., Gloucester District office, has been appointed to the construction (transmission) staff of the British Electricity Authority. Mr. Ridsdale is

Senior officers of the South West Scotland Electricity Board

Left to right: (Seated) Messrs. J. Meek (secretary), C. W. Flint (accountant), W. Hutton (deputy-chairman), J. S. Pickles (chairman), J. Henderson (chief engineer) and J. Gogan (chief commercial officer). (Standing) Messrs. D. L. McDonald (legal assistant), D. Smith (manager, Lanarkshire Sub-Area), W. H. Wills (manager, Dumfries & Galloway Sub-Area), A. Kelso (manager, Glasgow Sub-Area), B. R. Vickers (section head, Commercial Department), A. E. Roots manager, Ayrshire Sub-Area), W. J. Cooper (sub-area liaison officer) and D. Ross (manager, Clyde Sub-Area)

secretary of the Western Centre I.E.E. Transmission Group and was for many years with the North-Eastern Electric Supply Co.

Visitors to the trade counter of the General Electric Co., Ltd., at Magnet House, Kingsway, will have noticed the absence of **Mrs. E. W. Turner**, who recently retired after thirty-three

Mrs. E. W. Turner being presented with cheques from the General Electric Co., Ltd., and her colleagues by Mr. T. W. Heather on her retirement after thirty-three years with the company

years' service with the company. Mrs. Turner joined the counter staff in 1915 at Queen Victoria Street and was latterly in charge of the Fittings and Domestic Material Section. In addition to her normal duties she collected over £5,300 for War Savings. On her retirement she was presented with two cheques by Mr. T. W. Heather, sales manager, one from the company and one from her colleagues; she also received a "Medal of Merit," presented by Mr. W. J. Duffus, counter manager, on behalf of the counter staff.

Three of the five employees of the Jerusalem Electric & Public Service Corporation who were arrested by the Jewish authorities on charges of "espionage" were released last week—they are **Messrs. Bryant, Downs & Leech.** The other two, **Messrs. F. Sylvester & W. Hawkins** were brought before a magistrate on Monday last and charged, *inter alia*, with espionage, giving information to the enemy and collecting information of military value.

Mr. C. R. Westlake, M.I.E.E., chairman of the Uganda Electricity Board, has been appointed a member of a Colonial Office electrical mission to visit the Tennessee Valley Authority's development scheme. He is expected to arrive by air in London on his way to the United States on 8th September.

Sir Ernest Fisk, managing director of Electric & Musical Industries, Ltd., has been appointed honorary correspondent in electronics to the Museum of Technology and Applied Science, Sydney, N.S.W.

Obituary

Mr. Robert Buchanan Paul, M.C., A.M.I.E.E., overseas manager of British Insulated Callender's Cables, Ltd., died on 9th August at Weybridge, Surrey. Mr. Paul, whose early electrical training was with Mavor & Coulson, Ltd., Glasgow, joined the outside contract staff of British Insulated & Helsby Cables, Ltd., before the first world war, during which he served in the South Lancashire Regiment, rose to the rank of captain and was awarded the M.C. After the war he rejoined the company and went out to India to become manager for India of British Insulated Cables, Ltd. On returning to England he was made agency manager and personal assistant to the general manager. Later Mr. Paul became sales manager of British Insulated and when the merger with Callender's took place in 1945 he was appointed assistant overseas manager of British Insulated Callender's Cables, Ltd., and then finally overseas manager.

Mr. J. S. Dow.—The death occurred on 12th August of Mr. John Stewart Dow, B.SC., A.C.G.I., who had been prominently associated with the Illuminating Engineering Society since its foundation in 1909.

The late Mr. J. S. Dow

Mr. Dow was born in 1881 and after passing through a course in electrical engineering at the City and Guilds of London Engineering College he was for some years on the staff of the College and was later engaged on research work, chiefly on photometric problems. His early association with Leon Gaster led to the publication in 1908 of the *Illuminating Engineer* of which he was assistant editor and later editor, the name of the journal being changed to *Light and Lighting* in 1936. After serving as hon. assistant secretary of the Illuminating Engineering Society from its formation he became hon. secretary in 1928, a position he held until his election as president in 1946. When his term of presidency ended he continued to serve on the Council of the Society and during the whole thirty-nine years he was present at every Council meeting. He was a Fellow of the Society and in 1942 was elected an honorary life member, an honour which was shared only by the late Mr. A. P. Trotter.

Mr. Dow was a member of the Departmental Committee on Factory Lighting and of the Illumination Research Committee as well as the Lighting Committee of the Building Research Board and numerous other committees con-

cerned with lighting. He also served as hon. secretary of the Association of Public Lighting Engineers from 1931 until the end of 1935.

Mr. W. K. Whigham.—The death occurred on 14th August at the age of seventy of Mr. Walter Kennedy Whigham, O.B.E., who had been a member of the Central Electricity Board from its inception in 1927, and for a period represented the Board on the North of Scotland Hydro-Electric Board, from which he resigned in 1944 owing to ill-health. He was chiefly interested in banking and was for many years a member of the Court of Directors of the Bank of England. He was largely responsible for the financial affairs of the Central Electricity Board.

The late Mr. W. K. Whigham

Mr. Wilfred Morley Ratcliffe, J.P., M.I.MECH.E., joint managing director of Heenan & Froude, Ltd., whose death on 6th August we briefly reported in our last issue, began his engineering career by serving his apprenticeship with Hick, Hargreaves & Co., Ltd., and after a period with Bennis Combustion, Ltd., he joined Heenan & Froude, Ltd., in July, 1910, as a draughtsman. Between 1911 and 1918 he held successively the positions of chief estimator, assistant sales manager, and contracts manager of the Specialities Department, in the latter year becoming manager of the Department. He became general manager of the company in 1919 and in the following year a director; from 1936 to 1947 he was managing director, and at the time of his death he was joint managing director. He was also a director of a number of other companies. Mr. Ratcliffe joined the Management Board of the Engineering and Allied Employers' West of England Association in 1919, of which he was president from 1937 until his death. He was also a member of the Management Board of the Engineering and Allied Employers' National Federation.

Mr. John E. Lawson, president and general manager of the Canadian Niagara Power Co., died in Niagara Falls, Ontario, on 23rd July, at the age of sixty-seven. He started with the company in 1905 as an electrician.

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Mr. F. G. Gudgeon, manager of International Combustion, Ltd., left £18,738 gross (£18,611 net).

Mr. N. R. Adshead, a director of the Hydro-Electric Securities Corp., left £142,179 gross (£141,556 net).

Mr. L. W. Hawkins, formerly chairman of the London Committee of the Shanghai Electric Construction Co., Ltd., left £137,661 gross (£135,829 net).

Mr. Edwin Jacob, M.I.E.E., formerly a director of the Tudor Battery Co. and of Britannia Batteries, Ltd., who died on 6th April last, left £17,886 gross (£17,719 net).

Telephone Installations

Overtaking Arrears

IN a statement issued last week, the Post Office announced that 728,000 new telephones and 431,000 new exchange lines were installed during 1946-47. This compares with 401,000 telephones and 287,000 exchange lines installed in 1936-37, the peak year before the war. The number of telephone stations on the Post Office system at the end of March, 1947, was 4,318,816, an increase of 33 per cent on the pre-war figure. The waiting list for installations totalled 450,000. The need for exporting large quantities of telephone equipment prevented the Post Office from going ahead at the speed it would like to reach.

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Correspondence

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Recognition of Contractors

MR. A. MILNE, senr., contends that "it is nonsense to infer that because firms are members of the E.C.A. their clients can be guaranteed good installation work." Neither can one be sure that a doctor, a dentist or an architect is above criticism, merely because he belongs to his appropriate organization.

Such Associations however, including the E.C.A., exercise *control* over their members, and a contractor suspected of consistently bad installation work would soon be called upon to give an account of himself. Expulsion from a voluntary register for bad work, would not be a great calamity, but expulsion from the E.C.A. is a serious matter, sufficient in fact to put a contractor out of business. With the E.C.A. on the one hand and the Trade Union on the other, acting as watch dogs, the public has reasonable protection nowadays against disreputable electrical contractors, if there are any.

Mr. Milne goes on to say that the Register could be a powerful influence, "if all reputable contractors gave it their backing." None of us will dispute that, but Mr. Milne does not suggest how it is to be achieved.

Birmingham. W. A. GAZARD.

Engineers' Organizations

THE letter from "M.I.E.E." in your issue of 30th July must have found many supporters in the nationalized electricity supply industry. It is of course a fact that the chartered institutions cannot concern themselves with the working conditions of their members, though there are occasions when they could intervene usefully by at any rate declaring that the best cannot be expected from professional men and women unless they are reasonably treated. After all, this would only be an extension of the institutions' present benevolent activities.

As to the value of an independent organization (e.g., the Engineers' Guild), surely existing protective bodies such as N.A.L.G.O., E.P.E.A. and A.M.E.E. (in new guise) should be alive to the hardships and unfairnesses following the taking over of supply undertakings? What many of us find so inexcusable in both the new authority and the trade unions is the "iron curtain" which seems to be down. Much can be blamed on vesting day so soon following the Act. The new set-up is taking shape piecemeal and there is a growing suspicion that if you are not a "pusher" and are just quietly carrying on with your workaday job, you will later find yourself lucky to be fitted in at all.

Maybe you originally applied for a post (as all and sundry were invited to do, giving the impression of a fair field and no favour) and then you waited, finding long afterwards that your application had not even been considered. "M.I.E.E." puts in a plea for the chartered electrical engineers, but there are also the "unlettered" though experienced and tried engineers who also feel they are getting a raw deal and who would welcome even a gesture which showed that their existence, and hopes and fears, were known to the remote powers-that-be.

We do not even yet know what the superannuation and compensation conditions will be. Probably these have not been settled, and no doubt the over-soon implementing of the Act is to blame for this too. Some of us have had appointments offered on a provisional basis and it seems impossible for us to be sure whether we shall eventually be better or worse off, especially if daily travelling or removal is necessary. Of course, it is hoped that under the Act our former rights will be safeguarded—or shall we lose them if we accept one of these ungraded posts? We are in the same sort of doubt about old privileges in the way of benevolent schemes and cheap "juice" being continued.

So we are left wondering—and worrying. We are told by our seniors that there's no need to worry, but the sad thing is that even our advisers are not too happy, and for much the same reasons as ourselves.

SUPPLY ENGINEER.

Are Testimonials Necessary?

CANDIDATES for positions with the B.E.A. and Area Boards are in certain instances requested to enclose copies of two or more testimonials. This may be a relic of municipal practice where an Electricity Committee, particularly when making a technical appointment, required the assistance of two or three other gentlemen of standing, including the applicant's existing employer,

cerned with lighting. He also served as hon. secretary of the Association of Public Lighting Engineers from 1931 until the end of 1935.

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Mr. F. G. Gudgeon, manager of International Combustion, Ltd., left £18,738 gross (£18,611 net).

Mr. N. R. Adshead, a director of the Hydro-Electric Securities Corp., left £142,179 gross (£141,556 net).

Mr. L. W. Hawkins, formerly chairman of the London Committee of the Shanghai Electric Construction Co., Ltd., left £137,661 gross (£135,829 net).

Mr. Edwin Jacob, M.I.E.E., formerly a director of the Tudor Battery Co. and of Britannia Batteries, Ltd., who died on 6th April last, left £17,886 gross (£17,719 net).

Telephone Installations

Overtaking Arrears

IN a statement issued last week, the Post Office announced that 728,000 new telephones and 431,000 new exchange lines were installed during 1946-47. This compares with 401,000 telephones and 287,000 exchange lines installed in 1936-37, the peak year before the war. The number of telephone stations on the Post Office system at the end of March, 1947, was 4,318,816, an increase of 33 per cent on the pre-war figure. The waiting list for installations totalled 450,000. The need for exporting large quantities of telephone equipment prevented the Post Office from going ahead at the speed it would like to reach.

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Correspondence

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Recognition of Contractors

MR. A. MILNE, senr., contends that "it is nonsense to infer that because firms are members of the E.C.A. their clients can be guaranteed good installation work." Neither can one be sure that a doctor, a dentist or an architect is above criticism, merely because he belongs to his appropriate organization.

Such Associations however, including the E.C.A., exercise *control* over their members, and a contractor suspected of consistently bad installation work would soon be called upon to give an account of himself. Expulsion from a voluntary register for bad work, would not be a great calamity, but expulsion from the E.C.A. is a serious matter, sufficient in fact to put a contractor out of business. With the E.C.A. on the one hand and the Trade Union on the other, acting as watch dogs, the public has reasonable protection nowadays against disreputable electrical contractors, if there are any.

Mr. Milne goes on to say that the Register could be a powerful influence, "if all reputable contractors gave it their backing." None of us will dispute that, but Mr. Milne does not suggest how it is to be achieved.

Birmingham. W. A. GAZARD.

Engineers' Organizations

THE letter from "M.I.E.E." in your issue of 30th July must have found many supporters in the nationalized electricity supply industry. It is of course a fact that the chartered institutions cannot concern themselves with the working conditions of their members, though there are occasions when they could intervene usefully by at any rate declaring that the best cannot be expected from professional men and women unless they are reasonably treated. After all, this would only be an extension of the institutions' present benevolent activities.

As to the value of an independent organization (e.g., the Engineers' Guild), surely existing protective bodies such as N.A.L.G.O., E.P.E.A. and A.M.E.E. (in new guise) should be alive to the hardships and unfairnesses following the taking over of supply undertakings? What many of us find so inexcusable in both the new authority and the trade unions is the "iron curtain" which seems to be down. Much can be blamed on vesting day so soon following the Act. The new set-up is taking shape piecemeal and there is a growing suspicion that if you are not a "pusher" and are just quietly carrying on with your workaday job, you will later find yourself lucky to be fitted in at all.

Maybe you originally applied for a post (as all and sundry were invited to do, giving the impression of a fair field and no favour) and then you waited, finding long afterwards that your application had not even been considered. "M.I.E.E." puts in a plea for the chartered electrical engineers, but there are also the "unlettered" though experienced and tried engineers who also feel they are getting a raw deal and who would welcome even a gesture which showed that their existence, and hopes and fears, were known to the remote powers-that-be.

We do not even yet know what the superannuation and compensation conditions will be. Probably these have not been settled, and no doubt the over-soon implementing of the Act is to blame for this too. Some of us have had appointments offered on a provisional basis and it seems impossible for us to be sure whether we shall eventually be better or worse off, especially if daily travelling or removal is necessary. Of course, it is hoped that under the Act our former rights will be safeguarded—or shall we lose them if we accept one of these ungraded posts? We are in the same sort of doubt about old privileges in the way of benevolent schemes and cheap "juice" being continued.

So we are left wondering—and worrying. We are told by our seniors that there's no need to worry, but the sad thing is that even our advisers are not too happy, and for much the same reasons as ourselves.

SUPPLY ENGINEER.

Are Testimonials Necessary?

CANDIDATES for positions with the B.E.A. and Area Boards are in certain instances requested to enclose copies of two or more testimonials. This may be a relic of municipal practice where an Electricity Committee, particularly when making a technical appointment, required the assistance of two or three other gentlemen of standing, including the applicant's existing employer,

in assessing his qualifications. Could we not now dispense with this anachronism ?

A selection board, consisting of senior officers already engaged in the branch of the industry in which the vacancy exists, should not require such external evidence, and its absence would possibly make for a higher standard of interviewing practice; after all the committee would have the prospect of living with its errors ! Evidence should only be admitted in support of the truth of the candidates' statements and this could most conveniently be obtained after the interview, before a final choice is made.

BEDE.

Simple Network Solution

I MUST apologize for an unfortunate oversight in my recent article showing how the resistance between the opposite corners of a skeleton cube could be found by splitting certain conductors into two parts. As has been pointed out, the method is valid only when the circuit is symmetrical and this treatment cannot be applied to an asymmetrical circuit as shown in my Fig. 5. In this case the p.d. along the lengths of the two halves of the split conductors is changed, so the circuit conditions are upset. In the first example the potential of each point was undisturbed by the splitting, so a correct result was obtained.

I am grateful to your correspondents for drawing my attention to this error.

Cuffley, Herts. C. J. MITCHELL.

[It was pointed out last week by Mr. W. A. Snodgrass that the solution offered by Mr. C. J. Mitchell in the article in our issue of 6th August was incorrect. Several other correspondents have also pointed out that it was fallacious, including Dr. G. W. O. Howe, Glasgow; Mr. G. F. Freeman, West Ham Municipal College; " G.W.S.," who suggests other methods of calculation; and Mr. G. W. Chandler (meter superintendent, Eastern Electricity Board, Luton) who solves the problem without calculation by visualizing it in a different way.—*Editors*, ELECTRICAL REVIEW.]

Peak Load Problems

I HAVE read with interest the article in your issue of 6th August on " Peak Load Problems " and the Clow Committee's report. The components graph is most illuminating. I cannot, however, trace any consideration of the " reactive " load.

Why should the domestic, or any other particular, class of consumer suffer peak-load restrictions when there is such a gross waste of wattless current in the majority of inductive loads ? Power factor correction would go a long way to solve the present difficulties and some form of legislation should be passed to enforce it.

Birmingham. IAN S. PLUMTREE.

Earth Leakage Protection

UPON my return from a holiday out of reach of the *Electrical Review* I have read the Gilbertian and didactic contribution in your issue of 6th August. It would seem to overlook the fact that a fault can develop elsewhere than on a " phase conductor "—what about some way down a cooker element or motor winding, just to instance two common ones? Also it is intensely amusing to note that the electric circuit, when a fault develops, is left like the centipede, " considering how to run " !

I hold no brief for the current-balance type but had been asked to find out if such a thing was on the market and take this opportunity of thanking three firms who have written to me personally on the matter.

Riding Mill, Northumberland. E. FAWSSETT.

British and American Production

AS a statement of mine to the lay press has been misquoted, I hasten to correct a wrong impression. Asked whether I approved the visit of American production technicians to this country my reply was: " I could not use them in my business as I am a wholesaler and not a manufacturer." As regards the question of comparison of quality of our products I answered: " In accessories and some small appliances I think we make things of better quality than the Americans, but on the major appliances they make some superb products."

I should appreciate any publicity you can give to this explanation.

Sheffield. H. RILEY,
Director, John Riley & Son (Elecl.), Ltd.

Engineering Wages

On Monday last a Ministry of Labour court of inquiry began an investigation into the claim of the Confederation of Shipbuilding & Engineering Unions for an increase of 13s. a week in the wages of about 2,500,000 members. Later a similar inquiry will be made into the claim for higher wages of the shipbuilding workers.

British Electricity

AUTHORITY'S RECENT ACTIVITIES

THE British Electricity Authority announces that during the past month contracts have been placed for generating station, switching and transforming station and transmission equipment amounting in the aggregate to £1,701,036. The principal contracts include:—Additional schedules to existing contract for c.w. outlet tunnel and mains, Poole generating station (Sir Robert McAlpine & Sons (London), Ltd.; permanent way works for sidings, Usk Mouth generating station (Isca Foundry Co., Ltd.); coal handling plant, Keadby generating station (Spencer (Melksham), Ltd.); construction of foundations for main buildings, Barking "C" generating station (Sir Robert McAlpine & Sons); 3,000- and 415-V switchgear and accessories, Leeds (Skelton Grange) generating station (English Electric Co.); coal storage and reclamation plant, Sheffield (Neepsend) generating station (Mitchell Engineering, Ltd.); 132-kV switchgear, Windscale, Cumberland (Metropolitan-Vickers Electric Co., Ltd.); and 132-kV overhead lines, Windscale-Stainburn (Watsham's, Ltd.).

Summer School

THE first Summer School under the auspices of the British Electricity Authority and the fourteen Area Electricity Boards began last Sunday at Magdalen College, Oxford, and ends to-morrow (Saturday). It is being attended by 107 employees from all parts of the country who have been selected from all grades. They have been studying and discussing the new organization of the electricity supply industry. The school was opened with a short address by Lord Citrine, chairman of the Authority, on Sunday evening. The general programme for each of the following five days has consisted of a morning lecture and group discussion, followed by a general discussion, and in the evening a lecture and discussion, or films. Accommodation and meals have been provided at the College, the cost being borne by the Authority.

The lectures have included "Electricity as a Nationalized Industry," by Lord Citrine; "The Growth and Development of Electricity Supply," by Mr. J. Hacking, deputy chairman of the Authority; "Electricity Supply in Relation to the Economic Structure of the Country," by Mr. L. F. O'Donnell; "The Administration of the Electricity Supply Industry," by Sir Henry Self, deputy chairman of the Authority; "The Organization and Functions of Labour Relations and Welfare Departments" and "Recruitment and Training for the Electricity Supply Industry," by Mr. E. W. Bussey, full-time member of the Authority; "Electricity Supply as a Business and a Service," by Mr. J. Eccles, member of the Authority; and "Electricity in the Service of the Community," by Dame Caroline Haslett, member of the Authority.

The programme produced for the occasion took the form of a neat little booklet bearing on its cover a sketch of Magdalen College. Inside was a message from Lord Citrine stressing that the social advantages of such a gathering were as important as the business side. There followed a brief history of Magdalen and details of the arrangements which included tours of Oxford and coach excursions to Stratford and the Cotswolds. A list of the "students" was also included.

Arrangements for the School were in the hands of Mr. J. W. Thomas, chief education and training officer of the Authority, and Mr. R. A. Bellamy, his deputy.

Domestic Charges

ARRANGEMENTS have been made with the Area Boards to increase to a minimum of 0·75d. the running or "unit" charge of all two-part multiple, block or flat rate tariffs which do not include a coal-price adjustment clause. The main reason is that coal price increases introduced last winter, and wages advances operating from the first quarter of this year have made further additions to generating costs of the Authority.

As a first step towards the standardization of unit charges over the country it brings the comparatively few lower charge districts up to the level of the majority. In the main, the consumers who will have to pay more are the domestic and commercial users whose charges, unlike those of the majority of industrial consumers, have not been advanced in step with rising coal prices. The revised tariffs will come into operation as soon as practicable, probably following the next meter readings. For the country as a whole, it is estimated that the 0·75d. minimum will yield an extra £1,000,000 in the current financial year and £2,000,000 in a full year.

Earlier this year the B.E.A. arranged with the Area Boards to increase electricity charges in about 150 areas of the former undertakings. These adjustments only put into effect increases sanctioned before nationalization, or where there was clear evidence that an increase was necessary to avoid, or limit, a local loss. The present price revision is of a more general nature and has been made after a review of the financial position of the industry extending over several months. It is not connected with the Clow Committee's recommendation for differential tariffs in three winter months. How best to give effect to this is under examination.

Circulating Currents

Armature Testing and Adjustment Methods

By "ROTOR"

IN any dynamo the e.m.f. generated is proportional to the strength of the magnetic field acting on the armature conductors and to the speed of rotation. These factors also govern the value of the back e.m.f. generated in the armature of a motor. The arrangement of the armature windings determines the number of parallel circuits into which the windings are formed.

In a simple wave-wound armature, which theoretically need have only two sets of brushes, the armature windings form two parallel circuits, whatever the number of field poles. On each side of the brushes the armature coils form a circuit of conductors in series and the conductors in both parallel circuits are acted on by all the poles at any instant. In practice, however, large wave-wound armatures usually have as many sets of brushes, spaced one pole pitch apart, as there are poles, brushes of the same polarity being interconnected. Fig. 1 shows that the paralleling connection of brush sets in a multi-pole wave-wound armature may short-circuit one or more armature coils.

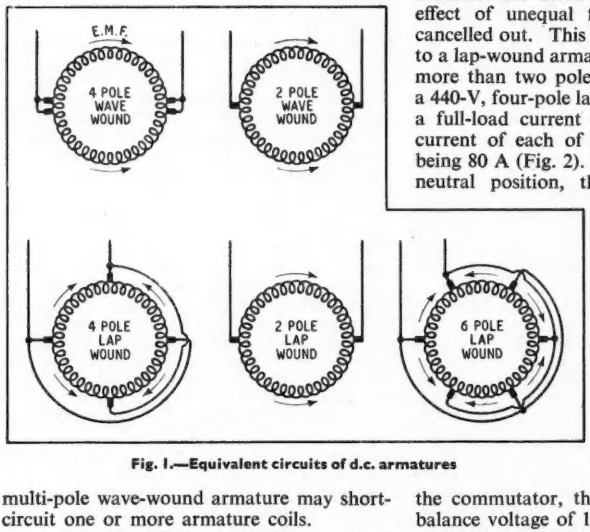


Fig. 1.—Equivalent circuits of d.c. armatures

In a lap-wound armature, the armature windings form the same number of parallel circuits as there are poles. Each armature circuit consists of a number of conductors in series, which are acted on by two adjacent poles only. The lap winding requires as many sets of brushes as there are poles, brushes of the same polarity, spaced a double pole pitch apart, being interconnected to parallel the various armature circuits. From Fig. 1 it may be seen that all the types of windings have a common characteristic in that removal of the brushes causes the various armature circuits to be connected in series. The generated e.m.f's in the various circuits do not act in the same direction and, with the brushes raised from the commutator, those acting round the armature should cancel out, giving zero voltage and armature current overall.

Effects of Unequal Circuits

A machine cannot, however, be perfectly symmetrical and the magnetic field strength of all the poles is not exactly alike. Since the coils in each circuit of a wave-wound armature are acted on by all the poles, the effect of unequal field strength is largely cancelled out. This condition does not apply to a lap-wound armature of a machine having more than two poles. As an example, take a 440-V, four-pole lap-wound machine having a full-load current of 160 A, the full-load current of each of its four sets of brushes being 80 A (Fig. 2). With the brushes in the neutral position, the armature coils they short-circuit during commutation, shown dotted, are exactly midway between the poles. Owing to unequal pole strength, or other cause, the e.m.f's in each circuit are assumed to have the different values indicated. If the machine were separately excited with the brushes raised from the commutator, there would be an out of balance voltage of 11·52 (= 468·8 + 455·36 — 455·4 — 458·24) acting round the armature. The total resistance of the armature is assumed to be 0·12 ohm, i.e. 0·48 ohm for

each of the circuits, so that the resistance of the four circuits connected in series by the raising of the brushes is 1·92 ohms. In consequence of the out-of-balance voltage a current of 6·0 A $\left(\frac{11{\cdot}52}{1{\cdot}92}\right)$ would flow round the armature, generating heat proportional to C^2R, equivalent to 69·12 W.

Conditions are changed considerably when the brushes are replaced on the commutator, as their interconnections will then parallel the armature circuits. Neglecting all resistance other than that of the armature windings (0·12 ohm), the normal drop in the armature under perfect conditions on full load would be 19·2 V (160 × 0·12), giving a normal no-load voltage of 459·2 and total armature copper losses (C^2R) of 3,072, or 768 W per circuit.

Actually, since the generated e.m.f. in the section of armature windings between the brushes D and A is 468·8 V, the drop across this section on full load is 468·8 — 440 = 28·8 V. The current in this section is thus 60 A $\left(\frac{28{\cdot}8}{0{\cdot}48}\right)$, and the loss 1,728 W. The circulating current in this section will be 20 A $\left(\frac{468{\cdot}8-459{\cdot}2}{0{\cdot}48}\right)$. The ringed figures on the diagram indicate the circulating currents in the armature windings and interconnections between the brushes when the machine is running on no load. These values will be superimposed on the normal full-load currents, giving the total currents marked on the diagram. The total copper loss on full load is thus equivalent to 3,344 W or 108·8 per cent of ideal conditions. In the most heavily loaded section between D and A the current is, however, 150 per cent of normal, and the rate of heating of the windings is 225 per cent of normal. Should the generated voltage in any section fall below the terminal voltage the current in this section will actually be reversed, with considerable increase of loading of the other sections.

Unequal voltages in parallel sections therefore cause the following effects:—Circulating currents and heating of windings on no load; increased heating of armature on load, particularly sections generating a high voltage; increased loading of certain brushes, possibly resulting in sparking and damage to the commutator; and unbalanced electromagnetic forces in the armature, which may cause increased stress on the shaft or undue wear of the bearings.

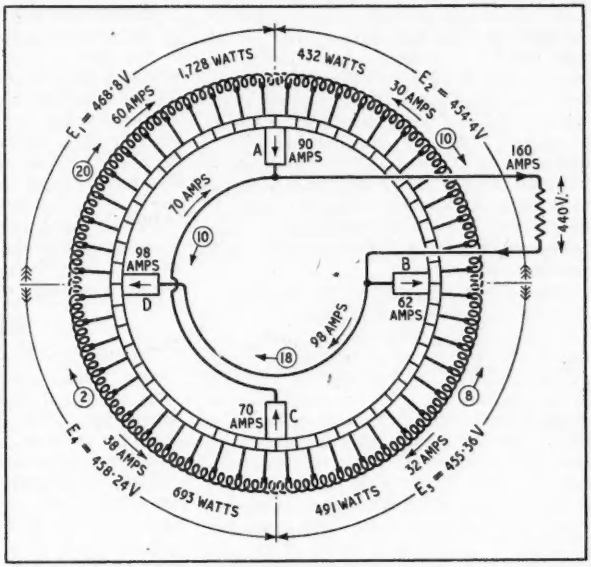


Fig. 2.—Current distribution in four-pole lap-wound armature with unbalanced fields

Circulating currents of this nature may be due to one or other of the following causes:—Unequal volt drop at brushes resulting from the use of different grades of brushes, sticking brushes, or unequal pressure on brushes; unequal parallel armature circuits from such causes as open circuit, short circuit, high-resistance connections, earth fault, reversed coil or unequal brush spacing, affecting both lap- and wave-wound armatures; unequal field strength acting on each armature circuit.

Armature Tests

An open circuit usually makes itself evident by violent sparking on load when the

segments connected to the faulty coil pass the brushes, as the circuit through part of the armature is then broken. These segments, and the mica between them, rapidly become marked by burning.

If a short-circuited coil is suspected a fairly large key or other light piece of iron may be held near the armature when running unloaded with the field excited. The magnetic field created by current flowing in the short-circuited coil will result in distinct pulsations of the iron. The short-circuited coil is much hotter than the sound coils and is liable to burn out quickly. Short circuits may be due to commutator segments being burred over, or to carbonization of intersegment mica. Sound mica should show a clean white surface when scraped.

More accurate results may be obtained by carrying out voltage-drop tests (Fig. 3). Current is passed between commutator segments 180 degrees apart with the armature at rest, the drop between adjacent segments being measured by a low-reading voltmeter. A suitable test current is about half the full-load value of the armature current. A very low reading indicates a short-circuited coil between the segments being measured, whilst a high reading indicates an open circuit or a high-resistance connection. The latter may be due to the melting of solder from commutator connections, sometimes caused by carbonized micas or overload. A reversed coil is rather rare, but is sometimes found on a rewound armature. This may be located by a compass needle when a direct current is passed through the stationary armature.

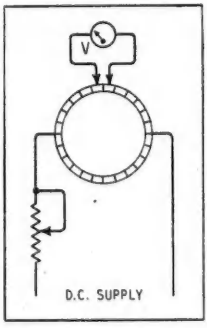


Fig. 3.—Circuit for armature volt drop tests

An earth fault can be disclosed by connecting an insulation test set between the shaft and commutator. For locating the earthed coil the circuit shown in Fig. 4 can be employed. A battery is connected in series with a limiting resistance between the shaft and a low-reading voltmeter with points spaced apart the width of a commutator segment. The main contact point is made to touch a segment so that the test current passes through the armature windings and earth fault. The voltage between this segment and those on either side of it are compared. The main contact point is then moved one segment in the direction of the greatest reading and the test repeated. If the greatest reading is still in the same direction the main contact point is advanced another segment, and so on, until a point is reached which gives a very small voltage reading when the contact point is placed on both adjacent segments. The faulty coil is the one connected to the segment touched by the main contact point and that immediately before it. Should the first contact point give approximately equal readings on either side of it the segments connected to the faulty coil are approximately one pole pitch away.

Field Tests

Another check for circulating currents entails removing all connections from the brushes and running the machine as a separately excited dynamo or with shunt fields fed from one positive and one negative brush only. The voltage between each pair of brush spindles of opposite polarity should give equal values if the machine is sound. Alternatively the voltage between spindles of the same polarity may be tested with a low-reading voltmeter; the result should be zero.

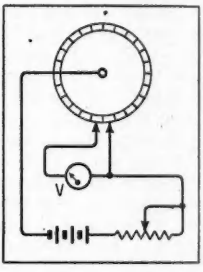


Fig. 4.—Test circuit for locating earth fault on armature

Where voltage tests reveal the presence of circulating currents the first step is to check the spacing between the sets of brushes, since this governs the number of armature coils in each of the parallel paths. Unequal spacing may be due to wrong setting of the brush holders on their spindles, so that some brushes are nearer to the commutator than others or to use of a brush box of the wrong type. A holder has been known to have been reversed on its spindle when a machine has been dismantled.

Unequal field strength may be due to a short-circuited field coil, whilst a reversed field coil will cause unbalanced armature currents. A short-circuited field coil will

usually be cooler than the sound coils. A method of locating a field coil having only part of its turns short-circuited is to measure the volt drop across each coil when the machine is energized. A low reading on one coil indicates a short circuit in that coil. Interpole and series-field coils can be tested with a low-reading voltmeter when the machine is running on a steady load.

To check the magnetic polarity of a shunt-field coil a compass needle can be used when the machine is running, preferably on light load, whilst interpole and series-field coils can be tested in the same way when the machine is loaded. The magnetic field produced by a given number of ampere-turns in a field coil depends on the reluctance of the magnetic circuit through which the flux passes. One big factor in the reluctance is the air-gap clearance between armature and field poles. Increased air gap under a pole face will increase the reluctance and reduce the field strength obtained with a given current, thus reducing the e.m.f. generated in the coils under the influence of that pole. Changed air gap may result from incorrect assembly of the machine, or wear of the bearings may have allowed the belt or other driving medium to pull the armature towards one pole or poles and away from others. It is, therefore, an advantage to test the radial air-gap clearance by long feeler gauges, but such readings should be accepted with reserve in the case of a machine having a vertical-belt drive, as the bearings may be worn on the top sides and the armature may rise when running. The amount of wear of the bearings may be tested, either directly by passing a feeler gauge between the shaft and a sleeve bearing, or estimated by levering the shaft up in its bearings.

Other possible but infrequent causes of unequal pole strength are blowholes in the yoke casting or unequal leakage between poles. The strength of a field coil may be increased by winding additional turns round the coil and connecting them in series with the existing turns or by reducing the air gap between the pole and armature by the careful fitting of a thin soft-iron piece under the pole or pole shoe. A strong pole can be weakened by connecting a diverter resistance in parallel with its coil.

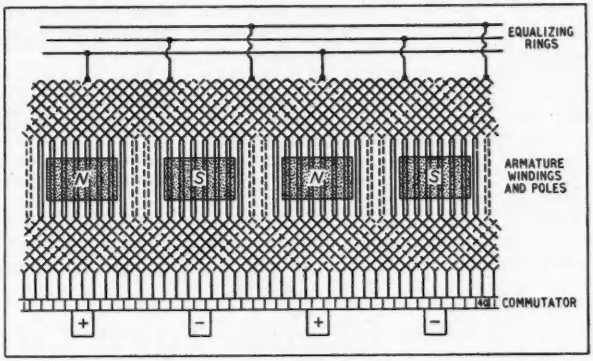


Fig. 5.—Developed plan of four-pole lap-wound armature with equalizers

Equalizers

Where other methods are unsatisfactory, equalizing connections can sometimes be fitted to relieve the commutator and brushgear of circulating currents. On large lap-wound armatures the connections are made to rings at the back of the armature or behind the commutator. Armature coils which have the same position in relation to poles of the same polarity should have the same potential and may be connected together; thus equalizing connections can be employed if the number of armature slots is a multiple of the number of poles. It is usual to provide one equalizing ring for about every six commutator segments; the number of points on the armature which can be connected to the same equalizer is equal to the number of pole pairs.

Circulating currents passing through the armature coils and equalizing rings tend to correct the unequal strength of poles which causes them. In Fig. 5, armature coils short-circuited by brushes in the commutating zone are shown dotted. Equalizing connections are not used on simplex wave windings but may be fitted on duplex wave windings. With a symmetrical duplex wave winding for all even numbers of pole pairs diametrically opposite commutator segments should be at

the same potential, and may be connected together by an equalizer.

Circulating Currents in Iron Parts

In some machines a magnetic field may pass between the bearings and shaft, in which case the shaft will act as a conductor and generate an e.m.f. in cutting this field. As a result circulating currents flow between the shaft and bearings, marking the shaft under the oil rings. Such undesirable magnetic fields may result from poor arrangement of the interconnections between brushgear, series-field coils or interpole coils, in a large machine. These connections should, as far as practicable, be arranged so as to neutralize each other's field.

To eliminate shaft currents of this nature, a bearing pedestal may be insulated from the machine frame or a bearing insulated in its housing. As an alternative a coil acting along the shaft in opposition to the shaft field may be connected in series with the armature.

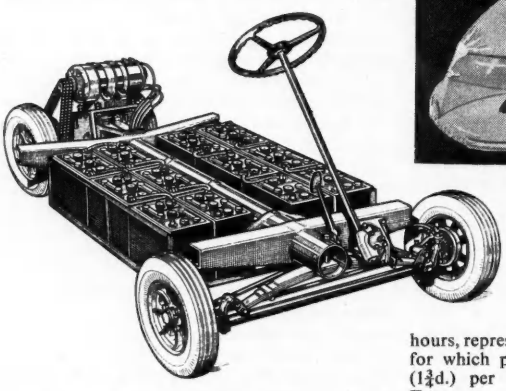
The changing magnetic field in an armature and pole shoes also tends to result in unwanted currents in these parts. Usually the high resistance of the iron and the insulation between the laminations are sufficient to limit the eddy currents to negligible proportions, but they may be increased as the result of damage to the insulation, as when an armature is allowed to rub on the pole shoes owing to worn bearings.

Electric Town Cars

NEW FRENCH DESIGNS

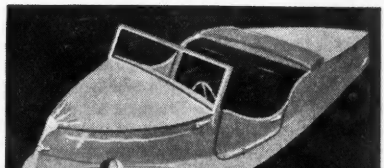
BATTERY-DRIVEN vehicles of a new type are now being produced on a large scale in Paris for use as passenger cars in town as well as for suburban delivery services. According to our Paris correspondent the distance covered per charge averages 70 km (about 43 miles) which should generally satisfy the needs of doctors, shoppers and many business men.

In contrast to the more usual low-speed designs the new vehicle is capable of travelling



at 45 km per hour (about 27 miles per hour) which is the average of all cars inside most city limits. Quick starting is one advantage while better braking and the "suppleness" of the vehicle enable it to be driven more quickly in heavy traffic than petrol-operated cars. Four speeds are available without de-clutching, since a gear box is not used.

Battery charging is through a rectifier, without transformer, fixed beneath the bonnet of the car to permit plug connection to any appropriate socket outlet without the driver needing to return to his own garage. The cost of



Left: Chassis (driving motor at rear) of French two-seater town car illustrated above

recharging the accumulator amounts to 1,000 fr. (one guinea) monthly for runs of about 50 km (30 miles) daily. The car battery is recharged completely in ten hours, representing a demand of 10 kW at 110 V, for which purpose a special tariff of 5·50 fr. (1¾d.) per kWh is offered by Electricité de France.

In addition to the two-seater car a 250-kg (5-cwt) light delivery van of much the same characteristics as the town car has been constructed to cater for the needs of shopkeepers. The vehicles are made by Pierre Faure, 20, Place de la Madeleine, Paris.

COMMERCE and INDUSTRY

Battery Production. Electricity Board's Coat of Arms.

PRELIMINARY results of the Partial Census of Production for 1946 have now been published in respect of the battery and accumulator trade. Value of production (gross output) was £15,188,000 against £6,967,000 in 1937. The value of sales of accumulators and parts was £9,301,000 (£3,192,000 production for sale in 1937), exports (f.o.b.) were valued at £2,087,000 (£597,000) and retained imports at £12,000 (£26,000). In the case of primary batteries and cells, and parts other than carbons, the value of 1946 sales was £4,715,000 (against £3,545,000 production for sale in 1937), with exports at £616,000 (£268,000) and retained imports at £9,000 (£47,000). Sales of other products were valued at £1,134,000 (£692,000 production in 1937). A table of materials, fuel, etc., used gives the total electricity purchased as 44·4 million kWh (against 24·7 million). Employees included 7,624 (6,630) males and 7,175 (5,502) females, the aggregate wages and salaries paid to them in 1946 amounting to £3,843,000.

Tin Statistics

The Ministry of Supply announces that existing arrangements for the publication of United Kingdom tin statistics are being changed. Full information will henceforth be available in the monthly Bulletin of the British Bureau of Non-Ferrous Metal Statistics and in the monthly Statistical Bulletin of the International Tin Study Group. The statistics in question are the monthly U.K. tin statistics and the quarterly figures for tin consumption by main trades incorporated in the quarterly statistics of non-ferrous metals. The Ministry of Supply will continue, as before, to arrange the details of international tin allocations and of official prices for tin.

Miscellaneous Goods Amendment Order

Under the Miscellaneous Goods (Maximum Prices) (Amendment No. 2) Order, 1948, which came into operation on 17th August, minor amendments are made to the Miscellaneous Goods (Maximum Prices) (Amendment) Order, 1948 (S.I. 1948 No. 776). It varies the scope of that Order by excluding thermal storage water heaters and certain types of wireless sets, and alters the definition of excluded iron and steel articles in the Second Schedule.

A.E.U.-E.P.E.A. Membership

It is stated in the August *Monthly Journal* of the Amalgamated Engineering Union that the Executive Council has had under consideration the position of members who may obtain employment in power stations in grades covered by the National Joint Board and has decided that dual membership of the A.E.U. and the Electrical Power Engineers' Association is permissible for these members.

Electricity Board Grant of Arms

The Lord Lyon King-of-Arms of Scotland has issued letters patent for arms for which the South West Scotland Electricity Board

Arms of the South West Scotland Electricity Board

applied earlier this year. The shield contains, in chief, the electricity device—a thunderbolt in gold adorned with silver wings—set on a green field, representing the agricultural background of the Board's area. The second compartment contains the Stewart device set between the Glasgow Salmon and the Clydesdale Cinquefoil. The third compartment contains the Galloway Lion in silver, set on a blue field. The shield is supported dexter by the Douglas and Hamilton Horse parted in the Board's principal colours of green and silver; and sinister by the Clydesdale Antelope similarly parted and differenced by the addition of a radiated collar suggestive of electrical power. In an escrol above the shield is placed the Board's motto, "Ad Altiora."

Air Ministry Fluorescent Fittings Contract

Hi-Craft Electrical Products, Ltd., inform us that its control gear has been approved and will be used exclusively throughout a contract which the Queensbury Engineering Co., Ltd., has received from the Air Ministry for fluorescent lighting fittings for the whole of its home and overseas establishments for the period of a

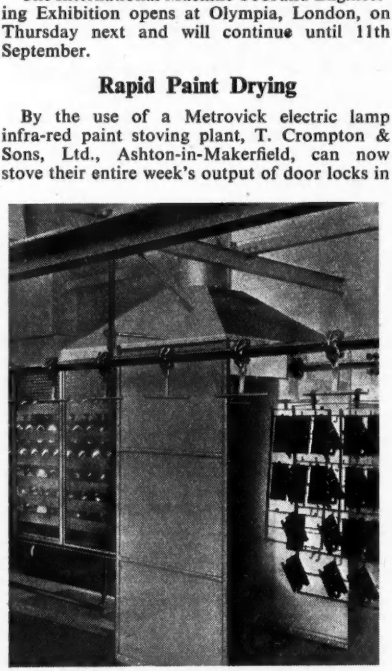
year. The fittings, which are in accordance with the Air Ministry's specification, include enamelled trough and flush fittings and control gear, concentrating fittings, angle concentrating fittings and bench mounting fittings.

Machine Tool Exhibition

The International Machine Tool and Engineering Exhibition opens at Olympia, London, on Thursday next and will continue until 11th September.

Rapid Paint Drying

By the use of a Metrovick electric lamp infra-red paint stoving plant, T. Crompton & Sons, Ltd., Ashton-in-Makerfield, can now stove their entire week's output of door locks in



Infra-red plant for paint stoving door locks

1½ days using half the number of employees. Before its installation a serious bottleneck existed in the paint shop where stoving by gas ovens took approximately 1½ hours for each oven loading. With the new infra-red plant gloss black painted locks are stoved in approximately 5 minutes and black wrinkle painted locks in 12 to 15 minutes, at temperatures of 460 deg F and 530 deg F respectively. Further a much improved finish is obtained.

The new plant is fitted with 216 infra-red industrial type 250-W lamps of the latest internal reflector design. These lamps obviate the necessity of fitting and consequently cleaning external type reflectors, and very considerably adds to overall efficiency. The lamps are built up in two vertical banks with heat control for stoving different components. The Metropolitan-Vickers Electrical Co., Ltd., in the first stages carried out exhaustive tests on the locks in its Infra-Red Demonstration Department at Long Acre, London, W.C.2, to ascertain the best types of paints to be used and to determine the necessary stoving cycle.

Railway Depot Modernized

British Railways' motive power depot at Polmadie, Glasgow, has recently been modernized and is now one of the most up-to-date in the country. Equipment includes coaling plant and ash-handling plant, the latter the only one of its type in the country, possibly in Europe. The locomotive ash-handling plant consists of four parallel ash pits floored with steel grids. The ashes are removed by two electrically-driven conveyor belts, carried to a cross-travel belt, and deposited on an inclined conveyor belt.

Public Lighting Engineer for Gateshead

After considering the organization of the Borough Engineer's Department for dealing with public lighting, Gateshead Town Council is to appoint a public lighting engineer. At present, plans and estimates concerning public lighting are prepared by the engineering assistants in the Department.

Institute of Welding

The annual report and accounts of the Institute of Welding for the year ended March, 1948, show that the financial affairs remain difficult because the reserves are small. Expenditure was £60 less than the income of £11,306. Raising the subscriptions a year ago increased the income by £1,842 in spite of a net loss of 180 in membership, which falling off seems now to be slowing down.

Fluorescent Lighting in Egypt

Among recent installations of G.E.C. fluorescent street lighting is one at Maadi, a garden suburb of Cairo. It consists of cut-off type lanterns housing either one or two 5-ft 80-W "Osram" fluorescent lamps, and the area lighted embraces a stretch of road and some grass-covered traffic islands. The mounting height is slightly less than 15 ft and spacing is approximately 132 ft.

Infringement of Factories Act

At the Sutton Coldfield Court on 10th August International Alloys, Ltd., Birmingham, were fined £50 with £1 19s. special costs for failing to take adequate precautions under the Factories Act. Mr. W. A. Bond, Inspector of Factories, who prosecuted, said that on 10th June workmen were required to move a machine to remove metal which had fallen underneath. A cable carrying 400 V passed over the machine and had been damaged, probably because it was taut. The earthing

cable was also damaged and anyone coming into contact with it would receive a shock. No evidence was called as the firm pleaded guilty.

One of the workmen, Michael Thomas Melville, was killed outright, and another was unable to let go of the machine. A third man who came to their assistance also received a shock. Mr. D. W. James, who defended, submitted that there was nothing the firm could have done to prevent the accident. The men working on the machine were entirely to blame. There had been inspections of the machine and nothing was reported to be wrong. The plea of guilty was entered, Mr. James added, not because the employers felt they were to blame, but because of the absolute duty which the Factories Act imposed upon them. There was a switch only four yards from the machine. The men were instructed verbally to switch off the current before moving the machine.

Liverpool Exhibition

In our reference on 6th August to the " Liverpool-Can-Make-It " exhibition the name of the company on whose stand fluorescent lighting employing circular tubes could be seen should have been given as Liver Aluminium Products, Ltd.

Overseas Inquiries

Australian Plaster Industries Pty., Ltd., Lorimer Street, South Melbourne, S.C.5, want electric vibrators for vibrating hoppers and chutes. (Ref. 38114/48.)

Sn. Luis H. Fregeiro, Calle Piedras 112, Montevideo, requires electric motors for refrigerating units. (Ref. 42105/47.)

The Central Public Works Department, Government of Pakistan, Chief Court Building, Karachi, want catalogues, etc., on building subjects and materials, including generating plant, air conditioning plant, electrical fittings and lifts. (Ref. 33100/7/48.)

The Eastern Electric & Engineering Co., 127, Mahatma Gandhi Road, Fort, Post Box 459, Bombay, 1, wishes to import public address amplifiers. (Ref. 38434/48.)

Etablissements Radio-Congres (Mr. G. Hubin) 7, Quai d'Amercoeur, Liége, wish to import refrigerators, washing and drying machines, and portable wireless sets. (Ref. 34539/48.)

Further information regarding these inquiries can be obtained from the Export Promotion Department, Thames House North, Millbank, London, S.W.1, quoting the reference numbers given.

Radio Communication Equipment

It is announced that arrangements have now been completed whereby the Plessey Co., Ltd., Ilford, will manufacture radio communication equipment under licence from the Bendix Corporation of America. The equipment, all of which will be completely interchangeable with the Bendix installations already in this country, includes mobile, ground and aircraft communication systems and radio navigational aids.

Electricity Output

During the week ended 7th August the output from solid-fuel fired stations was 577·6 million kWh. This compares with 584·0 million kWh in the preceding week and 500·0 million kWh in the corresponding week last year. Stocks of coal at power stations at 31st July amounted to 4,096,000 tons (equal to 5·8 winter weeks' consumption), compared with 3,529,000 tons (5·0 winter weeks' supply) at 2nd August, 1947.

Representation in Australia

Mr. G. B. Kafér, director of AC-Elec. Pty., Ltd., of St. Leonards, N.S.W., Australia, is visiting London this month and wishes to get into touch with British manufacturers of electrical equipment who are looking for Australian representatives or desire to arrange for their products to be made in Australia under royalties. Communications should be addressed to him, c/o Arthur F. Parris, 63, New Broad Street, London, E.C.2.

B.T.H. Hostel

Coton House, Rugby, has been bought from the executors of the late Mrs. Arthur James by the British-Thomson Houston Co., Ltd., which is to use the mansion as a hostel for its apprentices.

The Story of Bakelite

A record of achievement throughout forty-three years in the plastics manufacturing industry is provided in a well written and profusely illustrated 80-page book, which has recently been published under the title of " The History of Bakelite, Ltd." The author, Mr. T. J. Fielding, O.B.E., A.M.I.E.E., begins his historical survey in 1904, when the company was formed as the Fireproof Syndicate, Ltd., and Sir James Swinburne, F.R.S., who is at present chairman of Bakelite, Ltd., began his researches into the phenol-formaldehyde reaction. The story continues up to the end of 1947, outlining the company's various activities, together with the general trend of technical development in the industry. Apart from giving readers a clear conception of the progress and policy of the company, Mr. Fielding includes an indication of the increasing number of practical applications to which moulded materials are suited.

Dissolution of Partnerships

Messrs. H. T. Horner and D. M. Young, carrying on business as radio, television and electrical engineers at 225, Lower Addiscombe Road, Croydon, under the style of Horner & Young, have dissolved partnership. Mr. Horner

will attend to debts and carry on the business.

The partnership between Messrs. A. Reid and J. Wiggins, carrying on business as electrical contractors at 8, Greyhound Lane, Streatham Vale, London, S.W.16, under the style of Wiggins Electrical, has been dissolved. Mr. Wiggins will attend to debts and carry on the business.

Messrs. J. Simpson and W. Banks, carrying on business as radio and electrical engineers at 70, Ascot Terrace and 68, Ascot Avenue, Pontefract Lane, Leeds, under the style of Simpson & Banks, have dissolved partnership. Mr. Simpson will attend to debts.

Olympic Regatta at Henley

During the Olympic Regatta at Henley-on-Thames special permission was given for the floodlighting of the Town Hall, Thames Bridge and the Parish Church. In competitions for the best window display and the best decorated premises, organized by the Chamber of Trade and the Civic Society, the second prize was awarded to the Southern Electricity Board, Stuart Turner, Ltd., co-operating in the window display.

Changes of Name

Drawing Dies Maintenance, Ltd., will in future be known as Molybdenum & Tungsten Products, Ltd., a name more truly representative of present activities.

Reflex (Engineering & Electrical), Ltd., has also changed its name to Leflex (Export & Import), Ltd., and **F. H. Wheeler Wholesale, Ltd.,** has become Vauxhall Electric, Ltd.

Trade Publications

The Overseas Engineering Co., Ltd., 200, Bishopsgate, London, E.C.2.—Catalogue of lighting fittings for ships and yachts.

Vent-Axia, Ltd., 9, Victoria Street, London, S.W.1.—Priced folder illustrating 6, 9 and 12-in. exhaust fans.

Air Conditioning & Engineering, (N.I.) Ltd., 3, Bayley Street, Tottenham Court Road, London, W.C.1.—Priced leaflet on "Aircon" window fans.

The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Catalogue and price list of street lighting equipment.

The D.P. Battery Co., Ltd., Bakewell, Derbyshire.—Illustrated brochure showing some applications of "Kathanode" traction and marine type batteries.

The British Tabulating Machine Co., Ltd., 17, Park Lane, London, W.1.—Brochure describing the uses of electrically operated accounting machines.

Dawe Instruments, Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex.—Illustrated leaflet on the "Stroboflash" stroboscope and associated accessories.

Trade Marks

APPLICATIONS have been made for the registration of the following trade marks. Objections to any of the marks may be entered within a calendar month from the dates indicated.

4th August

I.C.I. (design). No. 660,989, Class 9. Electrical apparatus and instruments included in Class 9; scientific, weighing, measuring, signalling, wireless, etc., apparatus and instruments, etc.—Imperial Chemical Industries, Ltd., Wexham Road, Slough.

HARCOURTS (design). No. B655,842, Class 11. Electric lighting fittings made wholly or principally of metal.—Harcourts, Ltd., Rotherwas, Hereford.

SANCTUAR. No. B655,899, Class 11. Lamps and lampshades all made principally of Venetian glass and metal.—J. W. Wilcox, 153, Dyas Avenue, Great Barr, Birmingham, 22.

11th August

PURELLA. No. 662,406, Class 7. Washing, drying, ironing, mincing, mixing, stirring, whisking and cocktail shaking machines, and parts, not included in other classes, of all such machines.—Thorvald Moldkjaer, Tordenskjoldsgade 25, Copenhagen. Address for service: Trade Mark Owners' Association, Ltd., 50, Charing Cross, London, S.W.1.

PYROMATIC. No. 657,228, Class 9. Electrical apparatus and instruments and component parts thereof, all included in Class 9.—Welwyn Electrical Laboratories, Ltd., 70, Bridge Road East, Welwyn Garden City, Herts.

REVOMATIC. No. 660,781, Class 9. Electric switches, fuses, plugs and flat irons. No. 660,782, Class 11. Electric cooking and heating apparatus, lighting fittings, washboilers, fires and fans.—Revo Electric Co., Ltd., Groveland Road, Tividale, Tipton, Staffs.

SELECTRIX. No. B660,893, Class 9. Electrical apparatus included in Class 9.—Electrix, Ltd., Sterling Works, Dagenham.

ABWA. No. 661,107, Class 9. Fittings included in Class 9 for cables supplying electric current to moving vehicles, moving cranes and to similar industrial machinery; and apparatus for collecting electric current; and parts of all the aforesaid apparatus included in Class 9.—Anti-Attrition Metal Co., Ltd., Woodlands Park Works, Maidenhead.

MINI-MAG. No. B660,393, Class 10. Hearing aids for the deaf, and parts thereof not included in other classes.—Savory & Moore, Ltd., 61, Welbeck Street, London, W.1.

RAYTON. No. B658,655, Class 11. Electric water heaters and immersion heaters.—Santon, Ltd., Somerton Works, Newport, Mon.

ERALITE. No. 657,810, Class 14. Electric clocks.—Eralite Mfg. Co., Ltd., 194, The Broadway, Wimbledon, London, S.W.19.

Inflation and Distribution Costs

Consumption Expands in Spite of Shortages

By C. F. MATTHEWS, B.Sc., A.M.I.E.E.

PUBLIC concern has been roused by official references to tariff increases due to coal price and other rises. Outside industrial use, however, there have been and are strong compensating factors. Coal costs naturally hit our competitors, too, but far more important is it that cost increases which affect electricity are part of the *general inflation*, and the freezing of tariffs in inflationary periods lowers the *real* price of electricity to consumers, so producing an expansion in use as surely as would, in normal times, a lowering of tariffs. The fact that this expansion tends to bring the consumer on to lower-price blocks intensifies the process and, as is always the case, distribution costs per kWh diminish rapidly with expansion of use, a phenomenon we have witnessed in spite of shortages. In brief, inflation has produced an apparent rise in the elasticity of electricity.

Undertakings retailing at near bulk-supply costs must be embarrassed by coal cost rises, though nothing like to the full extent of the rise, but large numbers (including most rural areas) are not. Were shortages entirely absent their position would under present monetary conditions be stronger than ever it was. With many the opportunity is there for tariff reductions rather than the reverse.

Tariffs Determine Costs

Surveying the tariff-making studies of the Hydro-Electric Commission of Ontario, which in 1915-16 led to its present tariff, Mr. Leland Olds, New York, said that the conclusions could be expressed thus: "First reduce prices to levels which will enable consumers to absorb greatly expanded production and the resulting expansion will mean lower costs which will justify your prices economically." Similar is the T.V.A. chairman's statement that "One principle of pricing (for power) must be clearly recognized or the entire significance of the T.V.A. electricity program is obscured; *the tariff charged for electricity, within wide limits, determines the cost.* No analysis of tariffs for domestic electricity is worth serious consideration unless based upon this principle."

It was after a study of the "Hydro's" tariff primarily, as well as many other United States undertakings, that, in 1934, T.V.A. published its tariffs. The studies showed that the average distribution charges to homes were 2·5, 1·7, 1·1 and 0·7 cents for 600, 1,200, 2,400 and 4,800 kWh per year. Bulk power costs to be added were found at the time to average 0·7 cent per kWh with coal at $4 per ton. Like the "Hydro," T.V.A. plumped for block tariffs. Its first block was made 3 cents for 50 kWh per month, while the "Hydro" tariff then approximated to a service charge of 3 cents per 100 sq ft of room area plus 2 cents per kWh for the first 40 kWh per month and 1 cent for additional kWh. The Commission has stated that in its sparse rural areas the maximum economic limit for the first block is 6 cents with 2 cents for the second block. The whole emphasis of both organizations is on a low-priced first block to stimulate the expansion upon which their policy hinges.

Town and Country

The 140 or so independent municipal undertakings and rural co-operatives retailing T.V.A. bulk power sell at an average of 1·75 cents per kWh for homes. The difference between the municipal average and the co-operative average is about 0·4 cent. Rural consumption is slightly better than two-thirds of the towns' and there is generally a membership fee reflected in the average price; otherwise tariffs are identical and there is no question of towns assisting country areas. It is worth noting, too, that when these tariffs came into force, Tennessee farms averaged only $885 annual value of products and the average value of a farm dwelling was $563 and over nearly half the territory it was as low as $215 dollars average.

The tariff policy's effect on the undertaking's finances has been extremely satisfactory and within the last few months there have been amusing instances of local townsmen unsuccessfully trying to circumvent the clause in the bulk-supply contract (which stipulates that profits must be used to benefit the undertaking) by attempting to have plans passed for new electricity premises which upon investigation have disclosed surplus space admirably suited to dances and public

functions. The results are in face of material shortages and have certainly not been adversely affected by the inflationary movement which is being felt in Tennessee as in the United States generally.

Still unsurpassed, however, as typifying the effects of promotional tariffs on finances, is the history of the tariff-cutting war between the Montreal Power Co. and a small municipal undertaking in a suburb, Westmount. Keeping pace with its competitor, the company reduced its tariffs successively from 12⅜ cents to about 2 cents. Throughout the period the company's prosperity was steadily increasing. Even in the 1929-33 depression its $100 stock stood at $500 and it paid a dividend equivalent to 27 per cent on the original investment.

In Britain, too, distribution costs remain a fruitful field for reducing prices. It is not a matter of increased efficiency, an attribute which if political circles were believed, would have to work miracles. Many are the instances of small undertakings being absorbed into larger organizations with beneficial effect. This is rarely the result of increased "efficiency" in a physical sense, however (indeed, in many cases overheads are higher), but to the expansion in demand caused by bringing the tariffs of the small undertaking into line with the usually much lower tariffs of the purchasing organization with a consequent drop in kWh distribution costs.

An attitude derived from a belief in the need for substantial transference of profits from town to rural areas is inimical to progress. It is possible, if not probable, that shortages will have disappeared and the improvement in power station efficiencies will have wiped out much of the coal rise before inflation leaves us. As regards the domestic and rural field there is room for optimism.

Canadian Electrical Exports

STATISTICS FOR 1947

EXPORTS from Canada of electrical goods last year, according to preliminary figures just issued in Ottawa, totalled $19,135,000 in value compared with $20,939,000 in 1946. The principal groups and countries of destination in 1947 are shown in the accompanying table together with notes of increases or decreases compared with 1946. So widespread has Canadian export of electrical goods become that under the heading of "electrical apparatus n.o.p" no fewer than eighty-seven countries of destination are shown in the official returns.

Class and Destination	1947 $ (000)	Inc. or dec. on 1946 $ (000)
Batteries, storage	2,145	+ 1,326
To Holland	170	− 70
„ *South Africa*	549	+ 498
„ *India*	103	+ 77
„ *Malaya*	115	+ 115
„ *Colombia*	133	+ 82
„ *Venezuela*	170	+ 148
Batteries, other	306	+ 200
To Ceylon	193	+ 192
„ *Trinidad*	29	+ 5
„ *Jamaica*	17	− 5
Radio receiving sets	1,605	+ 1,180
Radio apparatus, other	1,146	— *
Dynamos, generators and parts	1,312	− 2,784
To United Kingdom	3	− 1,361
„ *New Zealand*	882	+ 768
„ *India*	12	+ 7
„ *Australia*	31	+ 31
„ *South Africa*	49	+ 2
„ *Brazil*	152	+ 144
Motors and parts	3,257	+ 2,708
To Australia	494	+ 287
„ *New Zealand*	377	+ 236
„ *Argentina*	180	+ 168
„ *Brazil*	220	+ 166
„ *China*	357	+ 352
„ *France*	121	+ 121
„ *U.S.S.R.*	578	+ 578
Transformers and parts	528	+ 292
To South Africa	13	+ 10
„ *New Zealand*	430	+ 416
„ *Mexico*	14	+ 9

Class and Destination	1947 $ (000)	Inc. or dec. on 1946 $ (000)
Meters and parts	1,157	+ 368
To Brazil	79	− 88
„ *Chile*	121	+ 52
„ *Colombia*	92	+ 61
„ *Cuba*	133	+ 22
„ *Mexico*	339	+ 165
Electric stoves	1,694	+ 693
To South Africa	878	+ 392
„ *Southern Rhodesia*	183	+ 112
„ *New Zealand*	81	+ 35
„ *Eire*	89	+ 21
Other domestic cooking and heating devices	435	+ 64
To South Africa	156	+ 40
„ *Brazil*	43	+ 21
„ *Colombia*	29	+ 8
Telegraph and telephone apparatus	133	+ 14
To India	15	+ 14
„ *Bermuda*	13	+ 8
„ *Chile*	13	+ 8
Spark plugs, magnetos, etc.	1,761	+ 327
To Sweden	118	+ 63
„ *South Africa*	396	− 14
„ *New Zealand*	161	− 11
„ *India*	62	+ 37
„ *Norway*	80	+ 71
„ *Brazil*	94	− 1
„ *Argentina*	100	+ 39
„ *Holland*	92	+ 67
„ *Belgium*	98	+ 98
„ *Mexico*	61	− 13
Electrical apparatus n.o.p.	2,957	*

*Comparative figures not available.

Trade with Canada

Mission's Bid for Increased Markets

By JOHN C. HANCOCK

THE departure this week-end of the Government-sponsored Trade Mission to Canada, concentrates attention on the prospects of developing our dollar trade. The Mission, representing a variety of products ranging from electrical goods to biscuit making machinery and sewage equipment is being led by Mr. E. H. Gilpin of Baker Perkins, Ltd. Mr. D. Maxwell Buist, M.I.E.E., B.E.A.M.A.'s export director, is representing the electrical industry and the Government member is Mr. C. Bennett of the Ministry of Supply.

In January last the President of the Board of Trade, Mr. Harold Wilson, stressed the urgency of seeking an increase in our volume of exports to Canada. At the same time he pointed out the difficulties which faced Canada and the United Kingdom as far as our mutual trade was concerned. He said that both countries were out to save dollars, while we for our part had to make sure of our food supplies.

Dollar Deficits

Canada, being a country accustomed to import largely from the United States of America, has in the past financed her deficit by a large export surplus to the United Kingdom. We no longer have enough dollars to pay the United States, (in spite of Marshall Aid) so that Canada, like ourselves, faces a serious dollar shortage. She must either get dollars by sending goods to the United States instead of to us, or save them by getting her imports from us rather than from the United States—neither of which is altogether easy. The President of the Board of Trade pointed out that Canada was most anxious that we should supply her with more goods. Whether the Trade Mission will further this objective, remains to be seen.

On the Canadian side there does seem to be evidence that a genuine attempt will be made to smooth a way for the import of British goods. For long it has been a complaint of United Kingdom manufacturers that their goods, complying in all respects with United Kingdom specifications and successful in most export markets, were not acceptable to the Canadians when confronted with the requirements of the Canadian Testing and Approving Regulations. Manufacturers of domestic electrical appliances will be aware, for instance, that they have been unable to market their goods in Canada owing to inability to obtain acceptable flexible cords. This matter has recently been taken up with the Canadian Standards Association with the result that the Canadian authorities, as a temporary measure, have agreed to accept some flexibles made to United Kingdom specifications. Further relaxations are expected.

Exchange Conservation

Against their acceptance of certain United Kingdom specifications must be set the provisions of the Canadian Emergency Exchange Conservation Act, of 24th March, 1948. The operation of this act is not directed specifically against British goods; in fact certain "quota" goods are admitted to Canada from sterling countries without restriction, the quota arrangement applying only in the case of goods manufactured or produced in "hard" currency areas. Under this Act certain goods in the Canadian Customs Tariff have been grouped in three schedules, namely:—

Schedule I. Prohibited Goods: This list includes such "inessential" products as refrigerators and radio receiving sets and cabinets and chassis therefor.

Schedule II. "*Quota*" *Goods:* The item of chief interest to the electrical manufacturer in this schedule is vacuum cleaners and attachments therefor.

Schedule III. Capital Goods: This list includes such items as electric motors and complete parts thereof for production use; and complete parts of electrical or radio apparatus.

The significance of this may be gauged if the latter item in Schedule III is compared with the item "Radio Receiving Sets," "prohibited" under Schedule I. The exporter would be well advised, however, to study the complete list of "prohibited" and "capital" items before attempting to enter the Canadian market.

The Canadian "three-decker" customs tariff shows a definite bias in favour of goods

originating in the United Kingdom. Thus, to take one example, certain electrical instruments (of a kind not manufactured in Canada) are admitted free under the British preferential tariff, while similar products are subject to a duty of 15 per cent under the "most favoured nation" tariff and 30 per cent under the general tariff.

Appointing Agents

When assessing the prospects of business in Canada it is as well not to lose sight of the fact that the Dominion is roughly forty times the size of the United Kingdom. When appointing an agent, therefore, it is important to define his sphere of activity, for it is a virtual impossibility for one agent to cover the whole of the Dominion successfully. To appoint an agent, say, in Winnipeg, for the whole of Canada would be on a par with expecting a representative in London to cover a territory bounded by, and including, Iceland and Norway in the north, and Morocco and Algeria in the south. Such an area would also include the whole of France and Spain, to say nothing of Italy and the Western Zones of Germany into the bargain.

FINANCIAL SECTION

Company News
Stock Exchange Activities

The Morgan Crucible Co., Ltd.—In the course of his speech at the annual meeting held on 11th August, Mr. P. Lindsay (chairman) said that in addition to a considerable expansion in sales during the year under review, they had achieved a greater degree of overall efficiency, and thanks to this, and in spite of a 200 per cent advance above pre-war in the weighted average cost of raw materials, their prices continued to be competitive in world markets. An appreciable part of their 33¼ per cent overall increase in turnover had been contributed by direct and indirect export. Recently they had registered a company of the name of Morgan Resistors operating in a new factory at Jarrow manufacturing components for wireless equipment, and they were in course of registering another company with the title of Morgan Refractories, for which they were erecting a factory in Cheshire for the large-scale production of a range of high-temperature refractories of recent conception.

The Hackbridge & Hewittic Electric Co., Ltd., reports a group trading profit for the year ended 31st March of £176,722, plus other income of £1,509, making £178,231, and a net profit of £52,995, as compared with £38,923 for the preceding year. Of this £1,293 is retained by the subsidiary company, and general reserve receives £15,000. The ordinary dividend for the year is 12 per cent and £27,055 is carried forward (against £24,453 brought in). In the previous year a dividend of 6 per cent was paid, but is not comparable owing to the amalgamation and capital reorganization in March, 1947, when the company was made public.

At a meeting on 7th September resolutions will be submitted to stockholders for increasing the capital to £800,000 by the creation of 200,000 ordinary 5s. shares. The new shares will be offered to ordinary stockholders in the proportion of one new share for each eight stock units held at a price of between 9s. and 10s. a share. The new capital is required to finance factory extensions and to provide additional working capital.

The Victoria Falls & Transvaal Power Co., Ltd., reports a net revenue for 1947 from power supplies and sundries, after providing for African taxation of £2,759,474, to which is added interest on investments £243,450, profit on sale of fixed assets, £29,268, fees, etc., £26,907, making £3,059,099. After providing for expenses in Johannesburg, London and Rhodesia, income tax, depreciation, etc., there is a net balance of £644,225. General reserve receives £150,000, and the ordinary distribution for the year is 19¼ per cent. The balance carried forward is £540,040 (against £423,940 brought in).

The report states that the board anticipates calling meetings towards the end of the year to place the company in voluntary liquidation. The company's undertaking was transferred to the Electricity Supply Commission of South Africa on 1st July last for the sum of £14,500,000.

The Nico Light Engineering Co., Ltd., reports a profit for the year ended 31st March last of £11,994, as compared with £9,164 for the previous year. The dividend for the year is 10 per cent, and a bonus of 5 per cent (both unchanged).

Parmiter, Hope & Sugden, Ltd., report a trading profit for the year ended 31st March last of £83,180, as compared with £56,341 for the preceding year, and a net profit of £34,809 (against £17,990). General reserve receives £25,000, and the ordinary dividend for the year is maintained at 30 per cent. The balance carried forward is £59,847 (against £59,741 brought in).

Waite & Son, Ltd., report a net profit for the year to 31st March last, before tax, of £8,097, as compared with £14,386 for the previous year. The dividend is unchanged at 5 per cent.

Newton Bros. (Derby), Ltd., report a net profit for the year ended 31st March last, after

providing for taxation, of £21,780, as compared with £16,047 for the preceding year. It is proposed to pay a dividend of 17½ per cent for the year (same), and a special bonus of 7½ per cent (same).

The **Cables Investment Trust, Ltd.,** reports a profit for the year ended 30th June last of £346,739, as compared with £296,118 for the preceding year. It is proposed to pay a final ordinary dividend of 3 per cent., again making 5 per cent for the year, and to carry forward £426,651 (against £390,386 brought in).

The **English Electric Co., Ltd.,** has declared an interim ordinary dividend of 4 per cent, less tax (unchanged).

New Companies

Batt-Wye Alarms, Ltd.—Registered 4th August. Capital, £700. Manufacturers, assemblers, installers and sellers of burglar and fire alarms and electrical instruments and apparatus, etc. Directors: F. Batty and J. D. Batty. Secretary: J. D. Batty. Regd. office: 202, Dewsbury Road, Leeds, 11.

John Williams & Sons, Ltd.—Registered in Dublin 31st July. Capital, £5,000. Electricians, general engineers, etc. Directors: J. Williams, Raheen House, South Douglas Road, Cork; M. Williams; and W. Williams.

Audiograph, Ltd.—Registered 5th August. Capital, £5,000. Designers and manufacturers of, and dealers in, sound recording machines, electrical, mechanical and general engineers, etc. Permanent directors: H. P. Samuel and A. S. Warburton. Regd. office: 7, St. Peter's Place, Birmingham.

George Gardner (Electricians), Ltd.—Registered 6th August. Capital, £1,000. Directors: G. V. Gardner, R. C. Moore and A. Firth. Secretary: K. C. Brown. Regd. office: Russell Chambers, 2, Whitfield Street, Gloucester.

Sew-Tric, Ltd. — Registered 6th August. Capital, £1,000. Manufacturers, repairers and dealers in dynamos, motors, armatures, magnetos, etc. Directors: R. E. Caudrelier and W. E. Glover. Secretary: R. T. Caudrelier. Regd. office: Spring House, Spring Place, Kentish Town, N.W.5.

Hooper's Telegraph & India Rubber Works, Ltd.—Registered 7th August. Capital, £50. Manufacturers and dealers in submarine and land telegraphs and telephones, and telegraph, telephone and electric lighting cables, wires, instruments and appliances, india rubber and gutta percha manufacturers and merchants, etc. Subscribers: H. G. Wells and F. Hopton. Solicitors: Linklaters & Paines, 6, Austin Friars, E.C.2.

E. G. Vine, Ltd.—Registered 11th August. Capital, £500. To acquire the business of an electrical engineer and contractor carried on by Edward G. Vine, at Felpham, Bognor Regis. Permanent directors: G. E. Shelley, E. G. Vine and S. J. Cockram. Secretary: G. E. Shelley. Regd. office: Admiralty House, Main Road, Felpham, Bognor Regis.

Speaking Signals, Ltd. — Registered 6th August. Capital, £5,000. Electrical and mechanical engineers, etc. Directors: K. T. Barlow, W. H. O. Jackson and P. A. Ivanoff. Regd. office: 10-12, Copthall Avenue, E.C.2.

Searle's Electrical Services, Ltd.—Registered 9th August. Capital, £500. Electrical and mechanical engineers, etc. Solicitors: Mawby, Barrie & Letts, 62-4, Moorgate, E.C.2.

Increases of Capital

Alkaline Batteries, Ltd. — Increased by £100,000, in £1 ordinary shares, beyond the registered capital of £100,000. On 5th May, Svenska Ackumulator Aktiebolaget Jungner, of Stockholm, held 20,494 ordinary shares, Joseph Lucas, Ltd., 10,000 preference and 12,500 ordinary shares, and Chloride Electrical Storage Co., Ltd., 18,850 preference and 38,154 ordinary shares.

Electronic Developments (Surrey), Ltd.—Increased by £2,500, in £1 ordinary shares, beyond the registered capital of £5,000.

Plomer & Wilkinson, Ltd.—Increased by £1,000, in £1 ordinary shares, beyond the registered capital of £5,000.

Electra (Birmingham 1935), Ltd.—Increased by £9,500, in £1 ordinary shares, beyond the registered capital of £500.

Private Arrangement

C. F. Stone, 627, Lord Street, Southport, electrical contractor.—At a meeting of creditors the statement of affairs showed liabilities totalling £2,235. The assets amounting to £1,982 were estimated to realize £1,382 and after allowing £100 for preferential claims, there was a deficiency of £953. It was decided that the matter should be dealt with under a deed of assignment to Mr. Gilbert H. Eaves, of Harry L. Price & Co., Manchester, and Mr. R. S. Woolley, Southport, as trustees, a family claim for £500 being withdrawn.

Liquidations

Union Electrical Co., Ltd. (in voluntary liquidation).—Particulars of claims by 31st August to Mr. J. A. Taylor, 1, Corporation Street, Hyde, Cheshire.

International Hydro-Electric Development Syndicate, Ltd.—Meetings 22nd September at 23, Plympton Road, Brondesbury, London, N.W.6, to hear an account of the winding-up by the liquidator, Mr. S. Howell.

Bankruptcy

A. E. Browne, electrician, Flat No. 2, "Southgate," St. Elfrides Road, Torquay.—Receiving order made, 27th July, on a creditor's petition.

METROVICK

Lighting

The young lady in the photograph is testing milk by the Resazurin method, in which light plays an important part, preferably a good source of north light.

As it was found that the variable nature of daylight was unsatisfactory Metrovick "Daylight" fluorescent tubular lighting was installed, with entirely successful results.

METROPOLITAN-VICKERS ELECTRICAL CO. LTD · NUMBER ONE KINGSWAY · LONDON · W.C.2

S/A 805

NEW BOOKS

Fault-Current Calculations. Maintenance of Motors.

Electronic Engineering. General Editor, E. Molloy. Pp. 108; figs. 97; index. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 5s.

This booklet deals with its subject from the practical viewpoint in a lucid and non-mathematical manner so that engineers and students alike are given ample opportunity of familiarizing themselves with the elements of this rapidly-developing science. It opens with a general survey of the development of electronic devices, mentioning several points of historic interest and continuing with a more detailed description of applications which are widely employed in industry to-day.

After a somewhat detailed discussion on the principles and applications of cathode-ray tubes the author gives a brief exposition of the theory of the diffraction camera. The gas-filled triode or thyratron also receives considerable attention, together with light-sensitive cells and associated circuits. The last two chapters are concerned with industrial X-ray equipment and r.f. heating.

Although such devices as the cyclotron, betatron and Geiger counter are primarily the concern of the nuclear physicist the editor has considered it necessary to include a brief outline of their operation as they are particularly important accessories in atomic energy research work. Without attempting to detract from the usefulness of the book, it seems rather a pity that so many of the practical examples have been chosen from equipment of American origin or manufacture.—A.R.P.

Calculation of Fault Currents in Electrical Networks. By R. T. Lythall, M.I.E.E. Pp. 75; figs. 86; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 12s. 6d.

The accurate evaluation of abnormal currents in 3-phase networks due to short-circuit and earth faults is a difficult technique involving the theory of symmetrical components. For many practical purposes the assumption that fault currents are balanced, or symmetrical, yields sufficiently approximate results and by making the further assumption that fault currents are limited only by reactance, calculations are simplified to an application of elementary circuit theory. This book deals with such simplified methods. The introductory chapter explains clearly how fault currents depend first on the rating of the plant, generators and motors, which tends to increase them and, secondly, upon the characteristics of the network which tends to limit them. The main body of the book deals with actual calculations by the percentage reactance and the ohmic methods, including a number of fully worked examples. The latter include many applications of the star-delta and delta-star transformation formulae and the derivation of these formulae might well have been given for the information of students.

The final chapter deals with the selection of circuit breakers based upon the results of fault current calculations. The book is a very useful introduction to the more advanced branches of the subject and it can be recommended to both intermediate students and practical transmission engineers.—G.W.S.

The Technique of Microwave Measurements. Edited by Carol G. Montgomery. Pp. 939; figs. 648; index. McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London, W.C.2. Price 60s. in U.K.

This book is one of the most important of the monumental series of 28 volumes compiled by the workers of the Radiation Laboratory of the Massachusetts Institute of Technology in order to put on record the great mass of information acquired in the course of the war-time developments of radar. The British counterpart is the special series of numbers of the Journal of the Institution of Electrical Engineers. There can be no doubt that the handier book form is a great asset, but the two series of works are in a sense complementary, for although the Radiation Laboratory Series surveys the whole field, the emphasis naturally falls on the American side of it, and it is therefore well that the British side should not be without its own monument.

The present volume is confined to measurements and it is remarkable that this one branch of radio measurements, almost entirely unknown before the war, now requires for its description a volume larger than the standard works which previously covered all branches of radio measurements. Fourteen authors have contributed to the book, and naturally their methods vary considerably, from a broad comparative treatment of the methods for making measurements on dielectrics for example, to a detailed consideration of the separate items, e.g., the methods of measuring power. All the branches are, however, systematically and competently covered and the book will immediately take its place as a standard work of reference for the specialist.—L.H.

Discharge Lamps for Photography & Projection. By H. K. Bourne. Pp. 424 + xv; fig. 186. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 36s. net.

In spite of the somewhat restrictive wording of the title, this book in fact covers the whole subject of discharge lamps in a way which will be of the utmost value to the lighting engineer and to everyone interested in their use for any purpose whatever. Further, there are two chapters on tungsten filament lamps now available for projection purposes and the carbon arcs which are still widely used in kinematography.

In his foreword, Mr. L. J. Davies mentions that the author has the great advantage of being an enthusiastic amateur photographer as well as an electrical engineer engaged at the research laboratories of the B.T.H. Company in designing many new types of discharge lamps for special purposes. This combination of interests and experience has enabled Mr. Bourne to produce a book which, it is probably true to say, could not have been so authoritatively written by any other single author.

The book is a mine of information which is either not available elsewhere or is scattered widely in the technical literature. Also, it is thoroughly up to date in spite of the long time needed for book production and the rapidity with which the subject dealt with is developing at the present time.—J.W.T.W.

Photo-Electric Cells in Industry. By R. C. Walker. Pp. 517; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, London, W.C.2. Price 40s.

The information in this book is presented almost wholly in a descriptive way so that the text is easily readable. The first six chapters, roughly 200 pages, describe the main types of cell, excluding photo-conductive types, and the basic circuits and associated amplifiers, relays, light sources, optical systems, etc., finishing off with counting and timing circuits. The remainder of the book deals with applications to machine control, light measuring instruments, television transmission, sound reproduction, facsimile picture transmission, alarms and indicators of all kinds.

As the author states in his preface, treatment is sometimes superficial. There are a few small errors. For example, on p. 89, fig. 3·5, the calibrating supply needs another connection to the rest of the circuit; on p. 60, fig. 2.6, a link is intended between the lower end of condenser 1 and the supply; on p. 148 scale sensitivities are at 17 cm not 17 mm.

The type is large and clear. The diagrams are in general strategically placed with reference to the text. The price is high, but so are most things nowadays.—L.W.

Electric Motor Maintenance. By W. W. McCullough. Pp. 126; figs. 24; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 12s.

This book is based on a series of American trade journal articles which preceded it. The author deals in a practical way with the periodical attention necessary to maintain in good working order various types of motors, motor-generator sets, frequency changers, gear drive motors and electric couplings.

The subject is treated in three distinct sections. The first part, which deals with mechanical maintenance, is very detailed; the information given in connection with different types of bearings should be most useful to persons responsible for the care and repair of electrical machines. Part two is concerned with electrical maintenance and includes some useful data on insulating materials and their characteristics. The treatment of motors which have become flooded is also described, together with insulation testing. The third section of the book deals with the operation and application of the various types of plant.

The outstanding theme is the periodical care desirable for the avoidance of breakdowns; it is sometimes overlooked that this should be the prime function of the maintenance staff, rather than the repair of plant which has broken down. At the same time, even with the most efficient maintenance, troubles do occur from time to time; for this reason a more extensive treatment of electrical faults and their diagnosis would have enhanced the value of the book. As an example, while mechanical causes of bad commutation are fully treated, there is little information about electrical causes. Motor control gear is not dealt with.

The manual is well indexed and the information given should make it a good investment for electrical inspectors, electricians and mechanics. —J.L.W.

Principles of Electricity. By H. Cotton, D.SC. Pp. 356; figs. 162; index. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 9s.

Believing that an acquaintance with the elementary facts of atomic structure is now part of common knowledge, Professor Cotton has discarded the traditional approach to electricity through the ebonite rod and pith ball. He has written an introduction to electrical science based from the start upon the modern idea of electron flow and has not hesitated to introduce, albeit simply, up-to-date conceptions like the electron gas or the polarization of dielectrics.

The scope of the book is roughly that of the Matriculation and School Certificate examinations, although some topics (the magnetic circuit) exceed these requirements. Terrestrial magnetism has been omitted through lack of space and electrostatics is given a prominence more in accord with its practical value than its historical interest.

The writing is lucid with practical and theoretical outlooks nicely balanced. The author always gives concrete examples of the orders of magnitude of the quantities mentioned, thereby driving home the practical significance of results too often learnt and used in mechanical fashion. Electrical calculations appear early in the book and the reader is well drilled in these before tackling the more abstract discussions of units which are usually so difficult for beginners. There are plenty of worked examples, exercises and test questions.

In conclusion, one may remark on the attractive format of the book with its large type, clear and effective diagrams and useful photographs of measuring instruments. It can be strongly recommended as a readable and up-to-date first text.—F.G.G.A.M.

Electricity Supply

Manchester Deficit. Darlington Transport.

Alnwick.—PROPOSED LIGHTING CONVERSION.—The Urban District Council has under consideration a proposal to convert all the existing street lighting from gas to electricity. The Council has also decided that all new lighting schemes shall be electric.

Birkenhead. — POWER STATION WORKS.—Notice is given in the *London Gazette* of various works which the British Electricity Authority proposes to carry out on the west bank of the River Mersey at the site of the Birkenhead power station near Bromborough. They include a jetty for loading ash into barges and circulating water intake and outlet openings. The new face of the cliff formed by the channel excavation is to be faced with a minimum of 3 ft thick mass concrete in steps to above high water level. Above this, to protect the cliff in front of the pump chambers, a gravity concerete wall is to be built for about a third of the frontage.

Heston and Isleworth.—STREET LIGHTING.—The Borough Council is recommended to approve a scheme for improved street lighting in Bath Road, by the provision of mercury vapour lighting costing £3,700.

Manchester. — DEFICIT ON ELECTRICITY UNDERTAKING.—In its last year of operation before being nationalized the Corporation's electricity undertaking showed a deficit of £72,514. This compares with a surplus of £9,441 in1946-47. Revenue was £52,489 higher at £3,412,422, but working expenses rose, too, from £2,977,589 to £3,104,792. After meeting the deficit, the reserve fund stood at £912,456 at 31st March. Sales of electricity rose from 806,220,000 kWh to 816,070,000 kWh and there was an increase of 6,332 in the number of consumers, making a total of 210,562. Considerable progress was made with the preliminary stages of the new Carrington power station construction.

Wallasey.—GAS WORKS INSTALLATION.—The Corporation has accepted the quotation of the Merseyside and North Wales Electricity Board amounting to £2,504 for extending and modernizing the electric power system at the gas works.

Workington.—STREET LIGHTING.—The T.C. has asked the Executive Officer of the North Western Electricity Board to submit a quotation for the public lighting of the new roads on the Salterbeck Housing Scheme.

Overseas

Aden.—ADDITIONAL PLANT.—Among projects to be undertaken within the ten-year period, 1946-56, is the provision of additional generating plant at an estimated cost of £100,000.

Australia.—TULLY FALLS PROJECT.—Estimated to cost £2,000,000, a scheme for a hydro-electric plant at Tully Falls, Queensland, is expected to be put in hand shortly.

Canada.—DEVELOPMENTS IN ONTARIO.—At the Ear Falls generating station which serves the mining areas of Red Lake and Pickle Crow, near the Manitoba border, Mr. Robert Saunders, chairman of the Ontario Hydro-Electric Commission, said that plans have been made for development of 270,000 h.p. at four new sites at boundary falls on the Winnipeg River, three miles from the Manitoba border, and at Kettle, Oak and Manitou Falls, on the English River. The Winnipeg River development will produce 150,000 h.p. and each of the others 40,000 h.p. The power developed by these proposed stations will make possible the inauguration of an entensive rural electrification programme.

TRANSPORT

Darlington.—TRANSPORT CONTROVERSY.—Representatives of the Town Council have had an interview with the British Transport Commission with reference to the plans for converting the Council's trolley-buses to oil-driven buses. The Transport Commission stated that the proposed conversion would ultimately help it to introduce an area scheme. Some members of the Council who proposed that oil buses should be used to supplement the trolley-buses and not to replace them, were accused of trying to prevent the Corporation's transport system coming under national control. Councillor M. Lyonette, chairman of the Transport Committee, appealed for an end to the controversy, which he stated had held up the placing of orders for oil buses for seventeen months. The matter was referred to the General Purposes Committee.

Felling-on-Tyne.—ACQUISITION OF TRAMWAYS.—The Urban District Council has asked Gateshead Corporation for a decision on Felling Council's proposal that the two Councils should consider taking over the Gateshead and District Tramways Co., Ltd., with a view to converting the system to trolley-buses.

Glasgow.—RECORD REVENUE.—Though the revenue of Glasgow Transport Department for the year ended 31st May, was a record, the accounts closed with an adverse balance. If fares are not increased in the current year the 1948-49 deficit is estimated to total £420,000. Total income was £5,310,435 and expenditure £5,118,975, showing a gross profit of £191,460. After the deduction of depreciation and income tax, a deficit of £103,620 remained. A surplus of £17,068 was returned by the underground system. The deficit was caused largely by increased salaries and wages and the contributions now required for National Insurance.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1940

METROPOLITAN-VICKERS Electrical Co., Ltd., and R. W. Bailey.—"Steam generators." 6206. 5th October, 1940. (Cognate application 8055/40.) (605695.)

1941

Telefonaktiebolaget L. M. Ericsson.—"Acoustic alarm devices." 11998. 13th February, 1940. (605774.)

1943

Westinghouse Electric International Co.—"Apparatus for the heat-treatment of metal strip or other elongated metal member." 15630. 31st October, 1942. (605776.) "Apparatus for heat-treating metallic strip material, particularly tin-coated steel strip." 17291. 20th January, 1943. (605777.)

1944

General Electric Co., Ltd., and D. C. Espley.—"Kinematograph projectors." 24437. 6th December, 1944. (605556.)

1945

Akt-Ges. für Technische Studien.—"Gas heaters, particularly for thermal power plants." 250. 13th November, 1943. (605557.)

Philco Corporation.—"Refrigeration apparatus." 6545. 17th March, 1944. (605560.)

British Thomson-Houston Co., Ltd., J. T. Anderson, R. S. Wells and H. F. Ward.—"Manufacture of luminescent material." 7021. 20th March, 1945. (605705.)

Marconi's Wireless Telegraph Co., Ltd.—"Electron-discharge devices and associated circuits." 9632. 17th April, 1944. (605782.)

Soc. Rateau.—"Regulating means for thermal gas turbine motive units used for driving electric direct current generators." 12586. 10th July, 1941. (605785.)

Triggs, W. W. (Automatic Canteen Co. of America).—"Electric selective beverage vending machine." 13980. 4th June, 1945. (605787.)

M. L. Telcs.—"Apparatus for the instantaneous reproduction of handwriting or drawings by wired or electromagnetic coupling of a local pen and accessories to a remote pen or cathode-ray tube or the like and associated equipment." 16413. 27th June, 1945. (605719.)

E. W. Bull and M. E. Pemberton.—"Circuit arrangements embodying cathode-ray tubes." 19378. 28th July, 1945. (605572.)

Phoenix Telephone & Electric Works, Ltd., and H. F. Downing.—"Apparatus for calling attendants and for like purposes." 21608. 23rd August, 1945. (605720.)

Sylvania Electric Products, Inc.—"Electrodes for electron-discharge devices." 23812. 6th January, 1944. (605577.)

G. Donaldson.—"Electric tumbler switches." 30951. 19th November, 1945. (605585.)

J. G. Yates, R. C. Robbins and T. P. Hvinden.—"High-frequency detecting and power measuring systems." 33976. 14th December, 1945. (605734.)

P. Standaert.—"Automatic washing-machines for crockery." 34210. 22nd June, 1944. (605736.)

H. C. Lord, T. Lord and B. M. Hartman (trading as L. L. H. Co.).—"Method and apparatus for applying high-frequency electric currents to thermodynamic chemical reactions." 34529. 22nd December, 1944. (605589.)

Metropolitan-Vickers Electrical Co., Ltd., H. Newsom and W. D. Sheers.—"Electric traction equipment." 34611. 20th December, 1945. (605738.)

Solvay & Cie.—"Electrolyzing apparatus with adjustable anodes." 34638. 4th August, 1943. (605790.)

Wall's, Ltd., and J. Bayliss.—"Electric radiators." 34892. 23rd December, 1946. (605741.)

Record Electrical Co., Ltd., and J. L. R. Record.—"Acceleration and deceleration testing instruments for motor and like vehicles." 35222. 31st December, 1945. (605592.)

Atlas Powder Co.—"Electric explosion initiators." 35233. 3rd March, 1945. (605596.)

T. E. Boynton and E. C. Whiffin.—"Electric plug couplings." 35236. 31st December, 1945. (605598.)

J. Forman.—"Electro-mechanical high-speed operating gear." 35312. 31st December, 1945. (605747.)

1946

Liquidometer Corporation.—"Electronic transmitters for electrical measuring devices." 51. 8th September, 1945. (605621.)

Metropolitan-Vickers Electrical Co., Ltd., and G. R. Mason.—"Pulleys for belt drives." 56. 1st January, 1946. (605622.)

Ferguson, Pailin, Ltd., and F. Grunewald.—"Fluid blast electric circuit breakers." 57. 1st January, 1946. (605623.)

H. Rottenburg.—"Electrical connection devices of the lampholder adaptor type." 119. 1st January, 1946. (605644.)

Lumalampan Aktiebolag, G. F. Axberg and H. V. Andersson.—"Electric incandescent lamps." 144. 2nd January, 1946. (605649.)

N. R. Booth.—"Electric fuse-holders." 147. 2nd January, 1946. (605650.)

British Thomson-Houston Co., Ltd., J. Dyson and R. Keitley.—"Heating of dielectric materials by high-frequency electromagnetic waves." 168. 2nd January, 1946. (605655.)

British Thomson-Houston Co., Ltd.—"Electromagnetic switching devices for protecting electric power systems." 170. 4th January, 1945. (605657.) "Temperature indicators." 171. 5th January, 1945. (605658.)

P. G. Forsyth.—"Alternating-current voltage control systems." 186. 2nd January, 1946. (605664.)

C. A. Leonard.—"Electrical automatic speed regulators for internal-combustion engines." 194. 10th January, 1945. (605665.)

British Thomson-Houston Co., Ltd., and T. W. Wilcox.—"Electrical over-current relays adapted to serve as circuit-breaker tripping devices." 269. 3rd January, 1946. (605684.)

Aveling-Barford, Ltd., and J. S. Stokes.—"Electric immersion heating apparatus." 285. 3rd January, 1946. (605689.)

Sangamo Weston, Ltd.—"Photoelectric measuring apparatus." 290. 2nd April, 1945. (605691.)

A. G. Crossland and A. S. Mansell.—"Electric lamp fittings." 326. 4th January, 1946. (605754.)

Westinghouse Electric International Co.—"Ignition electrodes." 349. 4th January, 1945. (605762.)

British Thomson-Houston Co., Ltd.—"Lightning arrestors." 399. 8th January, 1945. (605793.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—"High-voltage electrical apparatus incorporating lightning arrestors." 400. 4th January, 1946. (605794.)

Philips Lamps, Ltd.—"Devices for simultaneously tuning oscillatory circuits having different resonance frequencies." 451. 16th October, 1940. (605807.) "Circuits for amplitude or frequency detection of ultra-short waves." 453. 15th January, 1941. (605808.) "Electrical rectifying arrangements." 454. 20th January, 1941. (605809.) "Blocking-layer cell rectifying installations." 456. 27th January, 1941. (605810.) "Circuit arrangements for amplifying high-frequency electrical oscillations." 458. 30th December, 1940. (605811.) "Detonation meters for internal-combustion engines." 459. 7th January, 1941. (605812.) "Electric discharge tubes." 16940/1. 15th and 19th April, 1940, respectively. (605852/3.)

Lumalampen Aktiebolag.—"Electric incandescent lamps, discharge tubes, and the like." 536. 14th April, 1945. (605834.)

Carr Fastener Co., Ltd., and G. W. Clark.—"Electrical pin-receiving contacts for holders of thermionic valves, plugs or other devices." 568. 7th January, 1946. (605839.)

Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—"Magnetic circuits." 7437. 28th June, 1941. (605846.)

CONTRACT INFORMATION

ACCEPTED TENDERS AND PROSPECTIVE ELECTRICAL WORK

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Argentina.—BUENOS AIRES.—Institute Argentine de Promocion del Intercambio. Complete generating plant for seven power stations of the following capacities:—One 18,750 kW, one 12,000 kW, one 8,400 kW, one 2,550 kW, one 1,800 kW and two 1,450 kW. Tenders are required within ninety days from 24th June and should be sent to the Institute at Asesoria Tecnica, Cangallo 5524, Buenos Aires. (Ref. E.P.D. 38418/48.)*

Australia. — MELBOURNE. — 5th October. Deputy Director of Posts and Telegraphs. Switchboard type cords, induction coils and switch parts. Details are available at the Office of the High Commissioner for Australia, Australia House, Strand, London, W.C.2.

22nd September.—State Electricity Commission of Victoria. An electrically operated overburden spreader. (Ref. 19143/48.)*

Belfast.—3rd September. Electricity Department. Portable three-phase recording ammeter; and supply and erection of fire extinguishing apparatus at substations. (See this issue.)

Belgium.—BRUSSELS.—23rd August. Belgian Railways. Fluorescent lamps and fittings. (Ref. 39228/48.)*

Burnley.—6th September. Town Council. Wiring for extensions to Bank Hall Maternity Hospital. (See this issue.)

Musselburgh. — 11th September. Town Council. Electrical work for public wash-house extension. Schedules, etc., from burgh surveyor, Municipal Office.

New Zealand.—INVERCARGILL.—17th September. The Electricity Department. Six 50,000-kVA distribution transformers. (Ref. 38896/48.)*

South Africa.—PRETORIA.—15th November. City Council. Nine 33,000/11,500-V, 20,000-kVA on-load, tap-changing transformers to specification No. 325, obtainable from the Controller of Municipal Stores, Lorentz Street, Pretoria (£2 2s. per copy).

Stirlingshire.—1st September. County Council. Electrical work at Kilsyth Secondary School. Schedules from county clerk, County Offices, Viewforth, Stirling.

Sunderland.—Town Council. Electrical installation at the kitchen-dining rooms at the Barnes County Primary School and the Havelock Junior and Infant School. Plans by the education architect, Ryhope Road.

Swindon.—Application to tender by 23rd August. Wilts County Council Education Committee. Electric lighting, heating and power services at the Headlands Grammar School. (See this issue.)

Uruguay.—MONTEVIDEO.—8th September. Usinas Electricas y Telefonos del Estado. 6,500 condenser tubes and 13,000 tapped ferrules. (Ref. 39126/48).*

Wanstead and Woodford.—24th August. Corporation. Installation of 400-W mercury vapour lighting on various roads in the borough. (See this issue.)

Wantage.—28th August. Urban District Council. 15,000-g.p.h. booster pump with 17½-h.p. electric motor for water supply scheme. Guthrie Allsebrook, 29, Crown Street, Reading.

* Specifications may be inspected at the Export Promotion Department, Thames House North, Millbank, S.W.1.

Orders Placed

Cheshire.—County Council. Accepted. Internal telephone communication system in the new County Offices (£1,121).—Ericsson Telephones.

Newcastle-on-Tyne.—City Council. Accepted. Automatic telephone extensions at the Shotley Bridge Hospital (£245).—Automatic Telephone & Electric Co.

Reading. — Corporation Education Committee. Recommended. Installation of electric lighting and power at Coley School (£512), Grovelands School, including caretaker's house (£460) and Redlands School (£1,101).—Southern Electricity Board.

St. Ives.—R.D.C. Accepted. Electrical installations in converted R.A.F. hutments at Oldhurst (£186) and Wyton (£178).—Eastern Electricity Board. The only other tenderers were Sprudgin, Brown & Co. (£226 and £325 respectively).

Wallasey.—Corporation. Accepted. Electrical installation at Lingham county primary school (£410)—McBride & Nuttall.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Extensions to Broad Oak Printworks for Calico Printers' Association, Ltd.; J. H. Holt, Ltd., builders, Bacup Road Saw Mills, Waterfoot.

Berwick.—Houses (100) for the T.C.; borough engineer.

Bexhill-on-Sea.—Houses (20), Grange Court Drive, for T.C.; borough engineer.

Caernarvon.—Civic theatre for T.C. (£20,000); W. Rees Davies, borough surveyor.

Cardiff.—Dining rooms and kitchens at Cathays High School and Windsor Clive Primary Schools, for E.C.; city architect, City Hall.

Carlisle.—School at Belah for the E.C. (£76,000); city architect, 18, Fisher Street.

Chesterfield.—Lighting, electrical effects, etc., at the Corporation Theatre; borough surveyor.

Cippenham.—Infants' school, Western House estate, for Bucks E.C.; county architect, Aylesbury.

Crook and Willington.—Houses (100) at Low Mown Meadows for the U.D.C.; Page, Son & Hill, architects, 75, King Street, South Shields.

Croydon.—Fairchildes Secondary Modern School, for E.C. (£305,100); borough education architect, 38, High Street.

Cumberland.—Additions to the male ward at the County Mental Hospital for the C.C. (£12,000); C. B. Ross, builder, Carlisle.

Dudley.—Civic restaurant, Fisher Street, shops, Lodge Farm estate and houses, Sledmore Road, for T.C.; borough architect.

Eccles.—Houses (44), Swanage Road and Peel Park Road, for T.C.; J. J. & J. Massey, builders, Swinton.

Felling.—Houses (148) at High Lanes, Heworth, for the U.D.C.; direct labour.

Feltham.—Bedfont Primary School, for Middlesex E.C. (£160,000); county architect, Middlesex House, Vauxhall Bridge Road, S.W.1.

Filey.—Fire station, Mitford Street, for East Riding C.C.; L. A. Reynolds, county architect, County Hall, Beverley.

Glasgow.—Flats (88) at Crathie Drive for Corporation; city architect.

Three 10-storey blocks for Corporation (electric lifts) (£450,000); city architect.

Harrow.—Houses (48), Woodlands estate; Wm. Old, Ltd., builders, 433, Pinner Road, North Harrow.

Heckmondwike.—Houses (38) for U.D.C.; surveyor, Town Hall.

Hull.—Extensions to printing works, Alfred Gelder Street, for A. E. Jackson & Co.; Robinson & Sawdon, Ltd., builders, 95, Alexandra Road.

Jarrow.—New factory for British Celanese, Ltd., Bede estate; Cackett Burns Dick & McKellar, architects, 21, Ellison Place, Newcastle.

Keighley.—Houses (34), Moor View Grove; D. O'Connell, builder, Spring Avenue, Long Lee.

London.—CITY.—Office block, Holborn Viaduct, Charterhouse Street, Farringdon Street; T. P. Bennett & Son, architects, 43, Bloomsbury Square, W.C.1.

ROTHERHITHE.—Rebuilding three warehouses; Caledonian Wharfage Co., Ltd., Pottery Street.

STOKE NEWINGTON.—Library (£35,000), Woodberry Down, for T.C.; H. A. Gold, architect, Deacons Hill, Hastoe, Tring, Herts.

Longton.—New works; Taylor Tunnicliff, Ltd., Albion Works, High Street.

Machynlleth.—Houses (32) for U.D.C.; surveyor, Council Offices.

Manchester.—Second instalment of rebuilding Royal Exchange Buildings, Cross Street, Market Street, for Board (£198,000); Bradshaw, Gass & Hope, architects, 19, Silverwell Street, Bolton.

Reconstruction of Free Trade Hall for T.C.; city architect, Town Hall.

Office block, etc., Cheetwood Road, Cheetham Hill, for North Western Electricity Board (£65,000); A. Cassel & Sons, Ltd., builders, Teneriffe Street, Broughton, Salford, 7.

Library, Churnet Street, Collyhurst, for City Council; L. C. Howitt, city architect, Town Hall.

Garage and offices, Bamford Street and Bank Street, Clayton, for F.T.S. (Great Britain) Transport, Ltd.; H. Elder, architect, 66, Manchester Road, Wilmslow, Cheshire.

Additions to works, Victoria Street, Openshaw, Cooke & Ferguson, Ltd.; J. Frith, architect, 1, North Road, Audenshaw.

Newcastle-on-Tyne.—Electric light and power installation at Lingfield Primary School; G. Kenyon, city architect, 18, Cloth Market.

Extensions, British Glues & Chemicals, Ltd., White Street; J. W. Ellis & Co., architects, 9, Ellison Place.

North Shields.—Oil refinery for Trent Oil Products Development Co., Ltd., Halifax (£3,000,000).

Northumberland.—Modern school at Haltwhistle, for the C.C.; county architect, County Hall, Newcastle-on-Tyne.

Northwich.—Houses (2,000); Ministry of Health, Regional Office, Sunlight House, Quay Street, Manchester.

Oldham.—County College, Central site (£450,000) for E.C.; J. W. Hitching, education architect, Education Offices, Union Street West.

Plymouth.—Houses traditional type (720); Cornish unit type (300) and Easiform type (200) for T.C.; city architect, Western Lodge, Seymour Road.

Rishton.—Houses (40) for U.D.C. (£54,520); Middleton & Co. (Blackpool), Ltd., Banks Street, Blackpool.

Sedgley.—Houses (118), Gibbons Hill and Ettmore Road, for T.C.; borough surveyor.

Skegness.—Houses (58), Church Lane, for U.D.C.; surveyor, Council Offices.

Small Heath.—New primary schools, Holy Family R.C. Church, Coventry Road, for Rev. F. H. Drinkwater (£25,000); Peacock & Bewlay, architects, 83, Colmore Row, Birmingham.

Staines.—Branch library, 41, Clarence Street, Middlesex C.C.; county architect, Middlesex House, Vauxhall Bridge Road, S.W.1.

Surbiton.—Houses (40), Fuller's Way; Bunting Construction Co., Ltd., builders, 73, Acre Lane, S.W.2.